DOCUMENT RESUME

ED 184 685 PS 011 325

AUTHOR Olson, Christine: And Others
TITLE Early Childhood Educator's Nutrition Handbook.
INSTITUTION State Univ. of New York, Ithaca. Coll. of Agriculture and Life Sciences at Cornell Univ.; State Univ. of New York, Ithaca. Coll. of Human Ecology at Cornell Univ.
SPONS AGENCY Food and Nutrition Service (DOA), Washington, D.C.; New York State Education Dept., Albany.
PUB DATE Sep 79
NOTE 59p.; For related documents, see PS 011 324-326
AVAILABLE FROM Mailing Room 7, Research Park, Cornell University, Ithaca, NY 14853 ($20.00: Set of 3 also contains "Educator's Guide: Food Experiences for Young Children" and "Nutrition Activities: Preschoolers and Parents").

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS *Eating Habits; *Food; Health Activities; Health Needs; *Nutrition; *Nutrition Instruction; *Preschool Children; Preschool Education

ABSTRACT

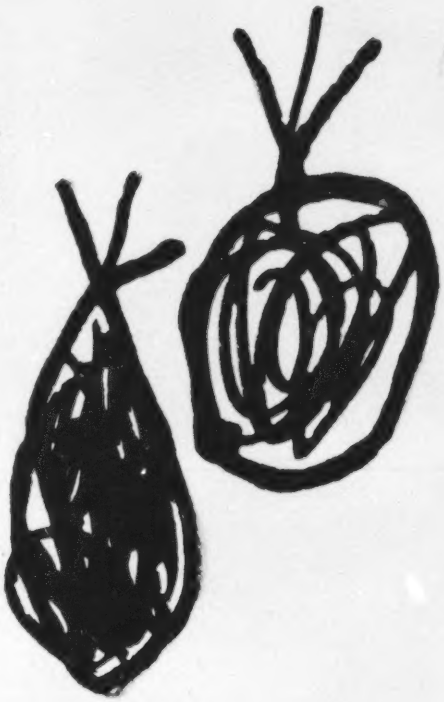
This nutrition handbook is designed to provide enough information on nutrition and food habits to enable early childhood educators to add a nutrition dimension to children's learning activities. Topics covered are the role of nutrition in growth during the preschool years; nutrients and their functions; selecting a healthy diet; common nutritional problems of young children; prevention of atherosclerosis and hypertension through good nutrition; food facts and fallacies; influences on food habits; the eating behavior of preschool children; the educator's role in developing good food habits; and nutrition education in preschool centers. Included in the appendices are national health statistics on growth standards, a list of the sources and functions of important nutrients, and recommended dietary allowances of the major nutrients. (SS)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED184685

U S DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION

THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY



Early Childhood Educator's: Nutrition Handbook

PS 011325

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
New York State Education Dept.
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

By Christine Olson and Jill Randell with Linda Morris

A publication of the Division of Nutritional Sciences, a Division of the New York State College of Human Ecology and the New York State College of Agriculture and Life Sciences, Statutory Colleges of the State University, Cornell University, Ithaca, New York. Cornell University is an equal opportunity, affirmative action educator and employer.

Components of the Early Childhood Nutrition Program are:

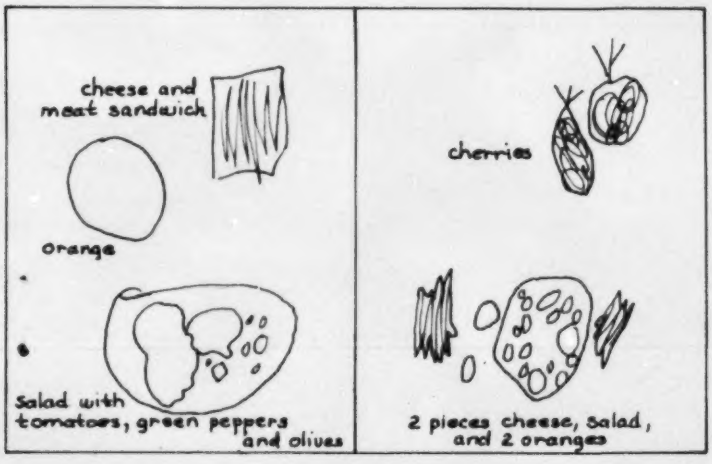
Educator's Guide: Food Experiences for Young Children

Nutrition Activities: Preschoolers and Parents

Early Childhood Educator's: Nutrition Handbook

Parents and Preschoolers: A Recipe for Good Nutrition
(A Flip Chart)

Project Designer, Pat Schultz, Visual Communications Group, Media Services.


cheese and meat sandwich
orange
Salad with tomatoes, green peppers and olives
cherries
2 pieces cheese, salad, and 2 oranges

The artwork on the cover was drawn by the afternoon class of the Cornell Nursery School.

early childhood nutrition program

Early Childhood Educator's Nutrition Handbook

by
Christine Olson,
Assistant Professor
and
Jill Randell,
Extension Associate
with
Linda Morris

An Extension Publication of the Division of Nutritional Sciences, a division of the New York State College of Agriculture and Life Sciences and the New York State College of Human Ecology, Statutory Colleges of the State University, Cornell University, Ithaca, New York.

Cooperative Extension, New York State College of Agriculture and Life Sciences, New York State College of Human Ecology and the New York State College of Veterinary Medicine, Cornell University and the U.S. Department of Agriculture, cooperating. In furtherance of Acts of Congress May 8 and June 30, 1914 and providing equal opportunities in employment and programs. Lucinda A. Noble, Director of Cooperative Extension, Ithaca, New York 14853.

Funded in part by the New York State Department of Education, NET Program, P.L. 95-166.

MAR 3 1 1980

Contents

Introduction 1
Nutrition for growth 3
Growth during preschool years 3
Growth standards 4
Nutrients & their functions 5
Selecting a healthy diet 9
Common nutritional problems of young children 13
Iron-deficiency anemia 13
Obesity 14
Dental caries 15
Other nutrition-related problems 16
The preventive approach in nutrition 19
Atherosclerosis 19
Hypertension 19
Food facts & fallacies 21
Vegetarian diets for children 21
Vitamin supplements 21
Organic foods 22
Natural foods & food additives 22
Snacking 23
Children & protein 23
Some food myths 23
Influences on food habits 25
Family 25
Taste 26
Television advertising 26
Preschoolers' eating behavior 29
Educators' role in developing good food habits 31
Nutrition education in preschool centers 33
Food activities 33
Involving food preparation workers 34
References 37
Appendices 41

Introduction

The poet Wordsworth wrote that the child is father of the man. Although he probably wasn't thinking about nutrition, the wisdom of that concept is as applicable to nutrition and eating habits as it is to other aspects of life. The eating patterns of adults have their roots in the eating habits established in early childhood. What and how children learn to eat and the atmosphere in which they eat will affect their food choices when adults.

The child who learns to snack on raw fruits and vegetables may continue to do so throughout life. Such a child not only increases his or her vitamin consumption but also decreases his or her likelihood of developing dental caries and obesity. The child who is given cupcakes, potato chips, or candy bars for snacks may establish a pattern of eating these low nutrient foods through adulthood. Such foods — high in fat, sugar, and salt — encourage dental caries and obesity and contribute to the risk of developing atherosclerosis and hypertension during adulthood.

Many preschoolers spend a large part of their days in child care facilities. They often eat snacks and noon meals at these centers, and the foods they are served must, by law, meet certain nutritional standards. Early childhood educators who serve nutritious foods and leave it at that may not be fully meeting the children's needs.

At the most basic level, nutritious food is only nutritious if eaten. Some preschoolers do not eat as much food as they might if some encouragement were used. There are several methods caregivers can use to get children to eat more and waste less food. Methods range from simply having an adult eat with children to letting children prepare their own food.

Just as important as food consumption is the opportunity for food discovery that educators will miss if eating times are simply times to eat, stuck in between more interesting activities.

Every aspect of life is an adventure for preschoolers, and there exist countless opportunities for learning. Eating is no exception. Early childhood educators who take advantage of eating as a chance to teach children about different foods are giving children more than nourishment. They are giving children the foundation of nutrition education. Upon this sound foundation will be built the good eating habits that can be a benefit for health throughout life.

Some caregivers may feel their own nutrition knowledge is inadequate to teach preschoolers about foods and nutrition. Or perhaps they are not aware of just how important good nutrition is, or how susceptible young children are to influences, bad or good, on eating habits. This nutrition handbook was designed to provide enough information on nutrition and food habits to enable early childhood educators to supply more than food at eating time and to add a nutrition dimension to children's learning activities.

Nutrition for growth

To understand how important nutrition is, one need look only at the growth occurring during early childhood. "She's growing right before our eyes" is a common remark among parents of preschoolers. The rate of growth is rapid at three to four years old, although actually it is slowing down, or decelerating, from the growth rate of infancy (see Figure 1).

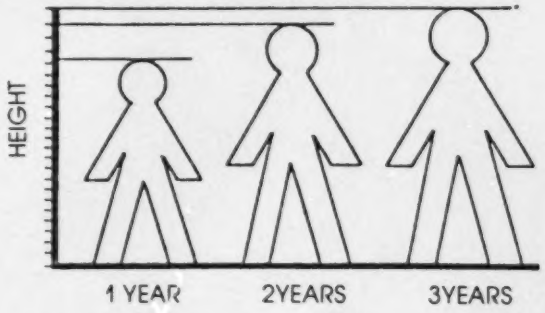


Figure 1. During the first year, average gains in height are over 3 times those in either the second or third year.

How much and at what rate a child will grow is determined by genetic makeup and by the mother's health during pregnancy. Many things — such as climate, disease, and nutrition — affect this growth potential after birth. Over- or undernutrition or an imbalance of nutrients can adversely alter a healthy pattern of growth. Healthy growth is the result of favorable external influences that allow a child to reach his or her genetically predetermined potential. We can't control all the environmental influences on a child's development, but we can insure that our children receive the proper nourishment required for growth.

Growth during preschool years

Growth occurs with the increase in number and size of body cells resulting in the increase in size of the body. Growth in the preschool years occurs primarily in the limbs. This is caused by rapid ossification of the long bones, which grow both in length and width. Teeth are also forming during the preschool years. Most of the first, or deciduous, teeth have appeared by the age of two. Permanent teeth develop from birth through adolescence, with the first permanent tooth appearing around age six.

Human growth is predictable. It can be expected to proceed in an orderly pattern with predictable periods of acceleration (growth spurts) and deceleration. Growth spurts occur in infancy and adolescence and are separated by a period of slower, more uniform growth in early childhood. Individual children vary in the timing, duration, and intensity of accelerated and decelerated periods of growth, but the variations will be consistent. For example, a child who grows more quickly than other children in infancy will likely continue the pattern and grow more quickly than others as an adolescent.

Growth standards

Growth standards have been developed as a means of visually comparing the growth of one child with the pattern of a group of children, with an average, or with the child's own past growth. When using growth standards it is important to remember that charts show averages of normal growth. Any individual's growth may be expected to fall above or below the average.

Height and weight are the measurements most often used to evaluate a child's progress because they constantly change with growth, are easily taken, and require no special training. The most commonly used standards for assessing growth in height and weight, the Stuart-Meredith Charts, were developed from studies done in Boston and Iowa in the early part of this century. The use of these charts was limited because they were based on measurements of white, middle-class children living 30 to 40 years ago. The need to update the Stuart-Meredith Charts was noted in 1971 by the U.S. Public Health Service (1). Since then the National Center for Health Statistics (NCHS) has compiled a new set of growth charts that enable the comparison of an individual child's measurements to those of all contemporary U.S. children of the same age and sex. NCHS growth charts and explanations for height and weight can be found in Appendix A.

Nutrients & their functions

The nutritional needs of preschool children are high because of the relatively high demands of growth. Since their growth rate is decelerating, preschoolers may have smaller appetites than infants, but their needs are greater now than in later childhood. Growth rate, nutritional needs, and appetite run parallel.

Protein is often considered the growth nutrient, but it is not the only nutrient needed. The body is made up of all the chemical compounds it takes for nourishment from food — proteins, carbohydrates, fats, vitamins, minerals, and water. These nutrients perform three functions in the body. They supply energy; regulate body processes; or promote the growth, maintenance, and repair of body tissues. Scientists have identified more than 50 nutrients that the body cannot do without. All of these nutrients are obtained from food but exist in varying amounts in different foods. No one food supplies all the needed nutrients and no one nutrient supplies total sustenance for the body. Although each nutrient has specific functions, it cannot accomplish its job without interacting or combining with other nutrients.

There are ten "leader nutrients." If enough of these are eaten daily, the other nutrients will also likely be consumed in sufficient amounts. The ten leader nutrients, which will be discussed in detail, are protein, carbohydrate, fat, vitamin A, vitamin C, thiamin, riboflavin, niacin, calcium, and iron. A chart of these nutrients, their functions and sources, plus a chart of other needed nutrients appears in Appendix B.

Energy

Energy is the body's most basic need, for it fuels not only growth but all the body's functions. The amount of energy a food supplies is measured in kilocalories — often referred to as calories. The new term for measuring energy in the United States is joule. One kilocalorie is 4.2 joules.

Three nutrients are capable of supplying energy to the body. These are protein, carbohydrate, and fat. One gram of protein or carbohydrate provides 4 kilocalories. One gram of fat provides 9 kilocalories. Energy requirements of children vary according to their growth rate, body size, and amount of physical activity. If more energy is consumed than used, the excess is stored as fat.

Protein

Protein can be used for energy, but its important functions lie elsewhere. New tissue cannot be formed without protein, because it is part of the structure of every cell. Hormones and enzymes, which regulate body processes, contain protein. Protein is needed to make hemoglobin in blood and is part of the antibodies that help fight infection.

Protein is made up of amino acids, eight of which must be supplied daily because the body cannot make them. These

indispensable amino acids are lysine, tryptophan, phenylalanine, methionine, threonine, leucine, isoleucine, and valine. Infants also require the amino acid histidine. Protein is "high quality" if it contains all eight essential amino acids in adequate amounts. Protein from animal sources is complete protein. That obtained by eating plant foods is incomplete because one or more amino acids are missing. Combining plant proteins so that one food supplies the missing amino acid of another results in complete protein.

Carbohydrate

Carbohydrates are the sugars and starches found mainly in plant foods, except for lactose, a carbohydrate found in milk. Sugars are found in plant juices and fruits. Starches (which are complex sugars) come from seeds, roots, and tubers. In digestion, carbohydrates are broken down and eventually converted into glucose, often called the blood sugar because it is the main sugar of the blood. Glucose is also the main supply of energy for the central nervous system. When carbohydrates are used for energy, protein is spared from that function and is left to its more important tasks of growth and repair of tissue.

Fat

The body needs fat. It is part of the structure of cells; it cushions vital organs, carries the fat-soluble vitamins, and helps the body use protein and carbohydrates more efficiently. All body cells, except those in the central nervous system, can use fatty acids for energy. Fats also provide linoleic acid, a fatty acid necessary for life.

Vitamins

Vitamins have become the most widely publicized nutrients. The body certainly cannot function without them, even though the amounts of vitamins needed are very small. Recommendations for vitamin intakes are measured in milligrams, one-thousandth of a gram, and in micrograms, one millionth of a gram. (There are 28 grams in an ounce.) Some vitamins are measured in International Units (IU), which measure how much of the vitamin is needed to promote growth or cure a deficiency disease.

Vitamins spark chemical reactions in the body that are necessary to release energy, build tissue, and control the body's use of food. Vitamins are often classified by their dissolvability; thus we have the fat-soluble vitamins A, D, E, and K and the water-soluble C, thiamin, riboflavin, niacin, and other B vitamins. The water-soluble vitamins are not stored in the body and must be consumed daily.

Vitamin A

Vitamin A is needed to build all body cells, for bone growth, and for healthy teeth. Combined with protein, it forms a substance known as visual purple, which regulates the eye's ability to adapt to changes in light. Vitamin A helps keep eyes moist and tear ducts working. It keeps the mucous membranes in the digestive tract, nose, and mouth healthy.

Vitamin A exists in two forms in foods. Preformed vitamin A, retinol, is found in animal foods and is ready for the body to use. Plants provide provitamin A, or carotene, which the body converts to vitamin A in the intestine. Orange and green leafy vegetables are high in provitamin A. Butter and fortified margarine supply large amounts of retinol. Milk is often fortified with vitamin A.

Vitamin C

Vitamin C is needed for growth of body cells because it plays a role in the formation of collagen, the substance that binds cells together. Wounds cannot heal nor bones repair without vitamin C. This vitamin also helps maintain healthy blood vessels and gums and sound teeth and bones. It helps to protect the body from infection, but to date vitamin C has not been proved to prevent or cure the common cold. Excellent sources are citrus fruits, green leafy vegetables, and broccoli.

Thiamin

Thiamin works in the enzyme system to release energy from carbohydrates. It also promotes good digestion and normal appetite and is needed for growth, healthy nerves, and muscle tone. Cereal products and meats are good sources.

Riboflavin

Riboflavin functions as part of enzymes that produce energy within cells. It is needed for healthy skin, tongue, mouth, lips, and for good vision in bright light. It helps the body use oxygen. Riboflavin is stored in a limited amount in the liver and kidneys, but most excess is excreted daily. Milk is the primary source of riboflavin, but it is also found in meats, green leafy vegetables, and cereal products.

Niacin

Niacin assists in the breakdown of carbohydrates for energy. It also keeps skin, mouth, tongue, and digestive system healthy and plays a role in keeping a healthy nervous system. The body can make niacin from the amino acid tryptophan. Good sources of niacin are meat, fish, poultry, eggs, and cereal products.

Minerals

Many minerals are needed to keep the body functioning healthily. Some are needed in large amounts, such as calcium, and are called macrominerals. Those needed in small amounts, such as iron, are microminerals. Minerals are not broken down by digestion.

Calcium

Calcium is needed throughout life, but it is especially crucial for preschool children because it functions in bone and tooth formation. United with phosphorus, it is deposited in and around the framework of bones to give structure and strength. Calcium gives developing teeth their rigidity. It helps blood clot and works with other minerals to promote a regular heartbeat. There must be vitamin D in the diet in order for calcium to be absorbed. Milk, which is the major source of calcium, is usually fortified with vitamin D. Exposure to the sun allows the body to convert a provitamin D in the body to vitamin D.

Iron

Iron combines with protein to make hemoglobin in blood. The ability of hemoglobin to carry oxygen from the lungs to the cells depends on its iron content. Because they are expanding their blood volume, children have high iron needs. Inadequate intakes of iron can result in iron-deficiency anemia. Preschool children are at high risk of developing this disorder (2). Food sources of iron include meats and dry beans. Many cereal products, especially ready-to-eat breakfast cereals, have been fortified with iron.

Selecting a healthy diet

There are several ways to insure that a child gets a nutritious diet. The simplest, but least accurate, way is to provide a diet of all kinds and colors of foods from animal and plant sources. Foods eaten should be high-nutrient density foods, meaning they have greater amounts of nutrients in proportion to calories. If low-nutrient-density, or empty-calorie, foods are avoided and a wide variety of other foods are consumed, you can be fairly certain that a child is satisfying most of his or her nutrition needs.

Nutritionists often compare the nutrient content of the foods a child eats to the Recommended Dietary Allowances (RDA) for the child's age group. The RDAs were developed by the Food and Nutrition Board of the National Research Council as a guide to amounts of nutrients that will meet the needs of almost every healthy person. They are grouped according to age and sex with separate recommendations for pregnant and lactating women. The RDAs for preschool children are found in Appendix C.

RDAs are not requirements for any individual but are suggestions for what are most likely the adequate amounts of nutrients. They are usually generous estimates based on height, weight, and calorie intake. Larger children probably will have higher nutrient needs, smaller children may have lower needs.

The RDAs should not be confused with the U.S. RDA, the U.S. Recommended Daily Allowances. The U.S. RDAs are the legal standards used in nutrition labeling; they were created by the Food and Drug Administration and were based on the highest RDAs for all sex-age groups. Thus U.S. RDAs are often much higher than the RDA.

Use of the RDA for planning a child's diet requires a reliable source on the nutrient content of foods. One such source is **Nutritive Value of Foods,** published by the Department of Agriculture (3). Appendix D contains **A Guide to Nutritive Value,** another helpful source.

Planning meals or analyzing a child's diet using RDAs may be too time consuming for teachers and caregivers. The traditional Four Food Groups can be useful for planning nutritious meals.

Grouped according to similar nutrient content, the Four Food Groups include Meat, which supplies protein, iron, niacin, and thiamin; Milk, supplying calcium, protein, and riboflavin; Fruits and Vegetables, supplying vitamins A and C; and Grain, supplying carbohydrate, niacin, some protein, thiamin, and iron. Figure 2 shows types of foods in the four groups plus recommended servings for preschoolers.

If children have foods from each Food Group at each meal, they'll be getting a good diet. Recommended daily servings for preschoolers are two servings from the Meat Group; two to three from Milk; four from Fruits and Vegetables; and four from Grain. These recommendations are just a guide: fast growing children and those with larger body builds may need more servings than smaller, more slowly growing children.

When planning servings, keep in mind that a child's serving is smaller than an adult portion. Preschool children's small appetites can sometimes disappear altogether when they see large amounts of food piled on their plates. One rule of thumb is to serve a child half an adult's portion. Or you can figure a serving to be one tablespoon of meat, fruit, or vegetable for every year in a child's age. A three-year-old would thus get 3 tablespoons of each food. The best practice is to start out small, serving a little less than you think the child can eat. If a child is still hungry, he or she will ask for more.

Unless food is properly handled, many nutrients can be lost in preparation. Some vitamins can be partially or completely destroyed by heat, light, and exposure to air. Water-soluble vitamins can be washed away in the cooking liquid.

Fruits and vegetables containing the water-soluble vitamins (C, thiamin, riboflavin, and niacin) retain more nutrients when steamed. Cooking in small amounts of water until just tender also helps conserve these vitamins. The liquid can be saved for soups or sauces. Overcooking destroys nutrients.

Figure 2: Servings needed by preschoolers from the Four Food Groups

	Servings per Day
Vegetables and fruits SERVING SIZE: 2–4 Tablespoons cooked 1/4–1/2 cup juice 1/2 cup raw	4
Dairy products SERVING SIZE: 1/2 cup milk or yogurt 3/4 ounce cheese 3/4 cup ice cream 1 cup cottage cheese	3
Grains– whole grain or enriched SERVING SIZE: 1/2–1 slice bread 1/2 roll or bagel 1/3–1/2 cup ready-to-eat cereal 2–4 Tablespoons cooked cereal 2–4 Tablespoons cooked rice, pasta or noodles	4
Protein products SERVING SIZE: 1–2 ounces cooked meat, fish or poultry 1 egg 1/2 cup cooked dried beans, lentils, or peas 2 Tablespoons peanut butter 1/4 cup nuts	2

Vitamin C is the most easily destroyed vitamin. Foods high in vitamin C should be used as quickly as possible and be refrigerated or frozen until used. Any method of preparation that exposes more of the fruit or vegetable surface to the air results in a loss of vitamin C. So finely chopped vegetables have less of the vitamin than coarsely chopped.

Thiamin is destroyed by heat and exposure to oxygen. Foods containing thiamin should be cooked at moderate or low temperatures with a lid on the cooking utensil.

Riboflavin is inactivated by light, so milk should never be stored in clear glass bottles.

High protein foods should be cooked at low or moderate temperatures.

Common nutritional problems of young children

All nutrients are available from food. Until the 1960s it was assumed that an abundant food supply in the United States meant that Americans were consuming nutritious diets. Events such as the CBS Reports on "Hunger in America" caused the government to look at the nutritional health of the U.S. population. The Ten State Nutrition Survey (1968–1970), the Preschool Nutrition Survey (1968–1970), and the Health and Nutrition Examination Survey (1971 ongoing) were sponsored by the Department of Health, Education and Welfare.

The Ten State Nutrition Survey (TSNS) focused on low-income families in 10 selected states. The Preschool Nutrition Survey (PNS) examined children aged one–six in all income levels throughout the country. The Health and Nutrition Examination Survey (HANES) is designed to measure the nutritional status, and changes therein, of the entire U.S. population. The first HANES survey was completed in 1972. The surveys employed different assessment methods and examined different population groups, but their conclusions were similar.

Nutritional disorders such as scurvy, rickets, and severe malnutrition, which are related to specific nutrient deficiencies, were practically nonexistent. Three major nutrition-related health problems, however, were discovered among all income groups: iron-deficiency anemia, obesity, and dental caries.

These disorders have one thing in common. They have grown from an American life-style that encourages poor eating habits. Filling up on empty-calorie foods has become one great American pastime. The high-calorie, high-fat, high-sugar foods eaten for snacks interfere with the appetite for meals when iron-rich foods are likely to be served. Combined with inactivity or simple overeating, these foods result in obesity. The constant quest to satisfy the American sweet tooth has contributed both to obesity and to the destruction of teeth.

Iron-deficiency anemia, obesity, and dental caries are serious health problems. They are all preventable.

Iron-deficiency anemia

Hemoglobin, formed by iron and protein, is the component of blood that carries oxygen to the cells. When too little iron is consumed, inadequate amounts of hemoglobin are formed. This condition of below-normal hemoglobin concentration in the blood is called iron-deficiency anemia. Symptoms of this anemia include fatigue, weakness, irritability, and pallor.

The nutrition surveys found that children in low-income families were more likely to have low hemoglobin concentrations than those in higher-income families. Although clinically diagnosed iron-deficiency anemia was found in only a small percent of the children examined, HANES found that fully 61 percent of the children in all income levels were receiving less than the RDA for iron (4). Repeated low iron intake increases the risk of developing iron-deficiency anemia.

Preschool children, aged two–five, are more likely to develop iron-deficiency anemia than any other age group (5). The younger the child, the greater the risk. The need for iron is high in preschoolers because rapid growth demands that new blood be formed. As the volume of blood increases, the hemoglobin concentration decreases unless enough iron is supplied.

Unfortunately, iron is not the easiest nutrient to get. Only about 10 percent of the iron in the average diet is absorbed by the body. Even when iron-rich foods are eaten, other foods may interfere with iron absorption. For example, a compound in eggs makes the iron in eggs unavailable for use by the body. On the other hand, some foods increase the absorbability of iron, such as foods containing vitamin C. Meat, especially liver, supplies a good amount of iron in the diet. Iron from animal sources is more readily absorbed than iron from plant foods.

Iron supplementation may seem like the easy answer to the iron intake problem, but with a little effort, the extra expense can be avoided. A carefully selected diet can supply a child's iron needs. Unsweetened fortified breakfast cereals, hot and cold, provide a substantial amount of a day's iron. Even snacks can contribute iron. Raisins and prunes are examples of snack foods containing iron.

Sometimes children do not get enough iron because they consume excessive amounts of milk everyday. Milk is nutritious and supplies several nutrients, but iron is not one of them. When one food is consumed to the exclusion of others, some nutrient will likely be missing — in this case, iron.

Obesity

Obesity is widespread in the United States, common to all age, sex, racial, and income groups. It is a serious disorder because it can contribute to the development of diabetes, high blood pressure, and atherosclerosis. The emotional and social problems of the obese can be as destructive as the medical ones. Obesity is a stubborn disorder to treat in adulthood. Few successful methods of treatment that result in long-term weight reduction have been found.

Obesity is defined as an excessive ratio of fat to fat-free body mass (6). There is no agreement among researchers as to just how much fat is excessive or at what point overweight becomes obese. The direct cause of obesity is simply overeating. More energy is consumed than is spent so the excess is stored in the body's adipose tissue. The causes of overeating, however, are many and complex and involve behavioral, emotional, and social factors. It is fairly accurate to say that obesity can result from the conversion of eating from its nutritive function of sustaining the body to nonnutritive uses of relieving tension, showing affection, or getting attention (7).

Children with obese parent(s) are at a very high risk of becoming obese themselves. This may or may not be caused by genetics.

Some researchers found that children with obese foster parents run the same risk of obesity as children whose biological parents are obese (8).

Whether fat infants necessarily become obese adults is still controversial among researchers. Some believe that overeating in childhood, when adipose cells are increasing in number, causes the formation of a greater number of these cells. Since the number of cells formed cannot be reversed, an overfed child has more potential storage space for excess fat in adulthood (9). This fat cell theory has not been proved. Perhaps a more important relationship exists between the habit of overeating in childhood and that habit carried into adulthood.

Most researchers agree that obesity is easier to prevent than to treat. Once overweight occurs it tends to persist or worsen (10). To prevent obesity a child must be taught sensible eating and exercise habits early on. Children can't form good habits if the adults who guide them set the stage for inappropriate use of food. The insecure mother who overfeeds her infant because she thinks a fat baby proves she's a good mother, the well-meaning parent who orders his or her child to finish every last bite on the plate, and the busy babysitter who offers food as a pacifier for fretful children are showing children that food should be eaten even when they aren't hungry.

Adults who urge children to be quiet and watch TV encourage the inactivity that contributes to obesity. Children often snack, almost unconsciously, when they watch television, which worsens the problem. Common snack foods are so high in calories and low in nutrients that children who consume them have to overeat, or consume excess calories, if they are to get all the nutrients they need for growth.

A fat child is not a healthy child and often not a happy one either. Dealing with overweight children is tricky. Severely restricted reducing diets that adults follow are not recommended for children because the low amount of calories allowed may leave out some nutrients that children need for growth. The best approach is to try to put a stop to overeating, particularly empty-calorie foods, and to encourage vigorous physical play for overweight children.

Dental caries

The most prevalent nutritional disorder today is dental caries, which is common to all income and age groups. Few of us haven't suffered from tooth decay, but most families consider it a fact of life not a preventable, nutrition-related disorder.

Dental caries, or tooth decay, results from acid produced by bacteria in the mouth. When these bacteria come in contact with a susceptible tooth and carbohydrate foods in the mouth, conditions are ripe for caries formation. Improper nutrition at the time a tooth is being formed can make it weaker and more susceptible to decay, although heredity also plays a role in the susceptibility of a tooth.

The favorite food of decay-producing bacteria is the carbohydrate sucrose, or table sugar, the refined sugar found in candies, sweetened baked goods, and presweetened cereals. Researchers have found that it is not so much the quantity of sucrose eaten that increases risk of tooth decay, but the form of the food and the amount of time it is in contact with a tooth. A definite link exists between high incidence of dental caries and high incidence of between-meal snacking. Sugary foods that are also sticky are the worst offenders because they adhere to the teeth, allowing the bacteria more time to act.

Most families are resigned to the fact that their children will bring home an unending procession of dental bills. Tooth decay however is preventable. Good nutrition during the time of tooth formation results in stronger, less susceptible teeth. Besides careful daily cleaning of the teeth, flouride treatment has been found to be effective in caries prevention (11). But preschoolers often lack the skill or patience to clean their teeth thoroughly. Children from rural areas may not have flouridated water. What these children eat becomes the important factor in preventing dental caries.

We can make sure that decay-producing bacteria are deprived of the foods on which they thrive. This doesn't mean that between-meal snacking should be banned. Children, especially preschoolers, often need to eat between meals because they can't eat all the nutrients they need in just three meals a day. Sticky sweet foods are not needed by any child. They not only help cause caries, but they have few nutrients. Good snacks include milk, cheese, yogurt, fruits, vegetables, fruit and vegetable juices, crackers, and bread.

The deciduous teeth of preschoolers are as important to protect from decay as are permanent teeth. By remaining in place, that is, not extracted because of decay, the first teeth allow the permanent teeth to develop properly.

Destruction of teeth by decay is permanent. Trips to the dentist's office to fill or pull teeth can be painful and expensive. How much easier it is to prevent dental caries by forming good eating habits that reduce consumption of sugar-laden foods.

Other nutrition-related problems

Although not caused by malnutrition, food allergies or sensitivities and lactose intolerance are nutritional problems that can lead to improper nutrition. It has been proposed, but evidence is not conclusive, that hyperkinesis is also a nutrition-related problem.

Food allergies

Children are potentially allergic to almost any food, but the most common offenders are wheat, milk, eggs, shellfish, and corn. Food additives sometimes cause allergic reactions. Some raw foods cause reactions but are not allergenic when cooked. Food allergy

can be trivial, or it can be life threatening. Reactions to foods can result in runny nose, diarrhea, vomiting, abdominal pain, swelling of the lips and tongue, irritability, hyperactivity, and rash. Reactions can occur anytime from almost immediately to 72 hours after the offending food is eaten.

Often what parents think is a food allergy really isn't. If a food allergy does exist, a consistent reaction to the offending food will appear in the dietary history or food diaries that are used to diagnose allergies. If a child is suspected of being allergic to a food, diagnosis should never be made by offering that food to the child to see if a reaction occurs.

Food allergy is treated by eliminating the suspected food in all forms from the diet. For example, baked goods, custards, and white sauces may cause an allergic reaction and would have to be eliminated from the diet of a child who is allergic to eggs.

When the food or foods causing the allergy cannot be identified, children are placed on strict diets that contain only those foods that almost never cause allergies. It is not a nutritionally complete diet and is followed only for six days to see whether symptoms go away. If the symptoms disappear, foods are added back until the offenders are identified. If symptoms do not go away, the problem is something other than food allergy.

Children who are allergic to several foods, or to basic foods such as wheat, are often unenthusiastic eaters because of the monotony of their restrictive diets. Some children see that their parents are concerned about what they eat and use acceptance and rejection of foods to exert control. Sometimes dietary supplementation is needed for children with food allergies. Efforts should be aimed at getting children interested in food and providing them with a relaxed atmosphere in which to eat.

Food additives & hyperkinesis

Ever since Dr. Benjamin Feingold suggested in 1975 that hyperkinesis could be treated through dietary management (12), controversy on the subject has flourished. Not the least controversial is the diagnosis of a hyperkinetic child.

Hyperkinesis, sometimes called the hyperkinetic behavior syndrome, includes the following symptoms: short attention span, poor concentration, inability to control physical activity, normal IQ but underachievement in school, and hyperactivity. Since the late 1950s, diagnoses of hyperkinesis have been increasing (13). This may be due in part to a tendency to label all "problem children" as hyperkinetic. In the past hyperkinesis was associated with emotional problems. Recently, researchers have come to believe that hyperkinesis is an organic problem (14).

Dr. Feingold claims that eating foods containing salicylates (a compound related to aspirin), artificial flavors, and colors causes hyperkinesis in some children, and that a diet eliminating these agents successfully treats hyperkinesis in half the children he studied. Studies have been conducted to verify his claims.

A few findings support Feingold's theory, although not to the extent he claims, while others do not. Not enough evidence is available to either totally dismiss the Feingold diet or to guarantee that it will work. Since a child can obtain a nutritious diet while following Feingold's diet, the matter is truly up to the child's parents and physician.

Lactose intolerance

A high percentage of children of African, Asian, and Latin American origin suffer from lactose intolerance. These children have a low level of lactase, which is the enzyme needed to digest lactose, the sugar in milk. Undigested lactose causes symptoms of bloating, cramps, and diarrhea. Lactose intolerance should not be confused with milk allergy, which is a reaction to the protein in milk.

Researchers previously believed lactose intolerance did not appear until the school years. Recently it has been found that a small number of preschoolers can be expected to have symptoms of lactose intolerance (15).

Large quantities of milk drunk at a single setting will undoubtedly cause unpleasant symptoms in these children. Since milk is such a rich source of calcium and riboflavin, it is unnecessary to exclude it from the diet of lactose intolerant children. Several small servings of milk throughout the day and especially at meals usually can be consumed with little or no discomfort. Dairy products such as cheese and yogurt in which the lactose has been fermented can be eaten with no problem.

The preventive approach in nutrition

Atherosclerosis and hypertension are two major health problems for the adult population of the United States. Atherosclerosis is responsible for more than half the deaths by cardiovascular heart disease. Hypertension, which can lead to heart disease and other serious health problems, affects 20 percent of adults over age 40. Several risk factors are involved in causing each of these diseases, diet being one. Studies have shown that the risk of developing atherosclerosis and hypertension can be reduced by restricting certain foods in the diets of adults. How early in life preventive measures should be taken is controversial among health professionals.

Atherosclerosis

Atherosclerosis is a slowly progressive disease beginning in childhood. Fatty deposits form on the walls of some blood vessels. Fat continues to gather on these deposits, or plaques, until the passage is so narrowed that if a clot forms it closes the vessel entirely. This results in lack of blood flow to the heart and ultimate heart failure. Cholesterol is a major constituent of the fatty deposits, or atherosclerotic plaques.

The chances of developing atherosclerosis are increased by several elements called risk factors. These include smoking, high blood pressure, and high levels of cholesterol in the blood. High blood levels of cholesterol are linked to eating large amounts of cholesterol and fat. Restricting cholesterol, fat, and saturated fats from the diets of adults is a generally accepted method of preventing atherosclerosis.

There is disagreement among scientists and doctors over whether cholesterol and saturated fats should be restricted in the diets of young children as a preventive measure. For children suffering from a genetic disorder known as familial hyperlipoproteinemia, there is no disagreement. These children have high levels of fat in their blood, which puts them at great risk of heart disease. They should be placed on restrictive diets early in life.

For most children, atherosclerosis is years, even decades away. Some researchers feel there is no point in taking early preventive measures because changes in the diets of adolescents and young adults seem effective. A concern exists that some harm might result if young children don't consume cholesterol, because it is used in the manufacture of sex hormones and is part of the covering of nerves and of the skin. However, the body can make cholesterol and seems able to make all that it needs without any from foods.

A diet geared toward low consumption of fat and cholesterol seems not to be harmful to young children (17). The benefits of a low-fat diet for children seem to outweigh the risks. Teaching a young child healthful habits that avoid high-fat foods seems an easier preventive measure than taking away established eating patterns of a young adult.

Hypertension

Research is increasingly suggesting that hypertension (high blood pressure) is a disorder of acquired dietary habits, such as

overnutrition and excessive salt intake, applied to an uncertain hereditary tendency to develop hypertension (16). Over 20 percent of American adults suffer from high blood pressure, making it a major health problem. At least 20 percent of American children can be expected to develop hypertension. The number of children already having hypertension varies from 1 percent to 12 percent (17). If untreated, hypertension can lead to heart disease, stroke, and kidney failure.

Hypertension is ten times more common in people 20 percent or more overweight than in the rest of the population (18). Reduction in weight often leads to lowered blood pressure in these people.

Studies of population groups that consume various amounts of salt (sodium chloride) have shown that the rate of hypertension increases with the corresponding rise in salt intake (19). Sodium is a vital part of the diet and is needed to maintain blood volume and the proper distribution of fluids in the body. It functions in the transmission of nerve impulses. Normally the body can adapt to a wide range of sodium intake by varying the amount of sodium excreted. If more salt is consumed than the kidneys can handle, more water is taken in, temporarily increasing the blood volume and creating higher blood pressure until the salt is excreted. Continual excess intake of salt can lead to continued high blood pressure.

When people who have hypertension reduce the amount of salt they eat, their blood pressure goes down. Still unproved is whether reduced salt intake by people with normal blood pressure has any advantages or can prevent hypertension. Therefore researchers disagree about reducing the amount of salt consumed by young children.

Few risks are connected with low salt intake in children. Iodized salt is the major source of iodine in the U.S. but the amount of iodine in 5 grams (about 2 teaspoons) of table salt fulfills the minimum requirements. Enough sodium exists naturally in various forms in food to satisfy the body's sodium needs.

Speaking realistically, a low-salt diet is difficult even for an adult to follow. Unless we obtain all our foods fresh, we have little control over the amount of salt we eat. Processed foods, both canned and frozen, and baked products contain substantial amounts of salt, but we shouldn't eliminate these foods from our diets. We also can't control the amount of salt added to foods in restaurants. Efforts to restrict salt intake should be aimed at choosing the least salty of processed foods. For example, canned vegetables contain much more salt than frozen vegetables. We can also refrain from adding additional salt to foods at the table, steer clear of salty snack foods such as potato chips, and avoid highly salted foods such as pickles, luncheon meats, and frankfurters.

The taste for salt is acquired, not inborn (20). It seems unnecessary, then, to teach children to enjoy highly salted foods. Since highly salted diets and overeating are risks in the development of hypertension, there seems little reason not to discourage these poor eating habits in our children.

Food facts & fallacies

The foods people choose to eat may reflect deep philosophical beliefs, or they may be based on totally irrational notions. Since parents often want their children to follow diets similar to their own, the nutrition and growth of children can sometimes be compromised. Here are some facts and fallacies about some contemporary nutrition-related beliefs.

Vegetarian diets for children

Increasing numbers of adults are turning to vegetarian diets. Usually spurred by religious or moral beliefs, parents who follow vegetarian diets are often adamant that their children do the same. A vegetarian diet may or may not be adequate for children, depending on the strictness of the diet and the parents' nutrition knowledge.

There are three types of vegetarian diets. Lacto-ovo-vegetarians eat plant foods plus dairy products and eggs. Such a diet can provide sufficient nutrients for children, as can a lacto-vegetarian diet, which includes plant foods and dairy products. A strict vegetarian or vegan diet, however, excludes everything except plant foods, and may be low in several nutrients.

A vegan diet especially may not provide sufficient quality and quantity of proteins and sufficient energy for the demands of childhood growth. Since plant protein is often incomplete, lacking one or more essential amino acids, foods have to be chosen carefully for protein and combined in a meal to form complete proteins. For example, grains combined with legumes complement each other and provide a high protein meal. Dairy products or eggs added to plant foods will also increase their protein value.

All vegetarian diets are likely to be low in iron, especially since the iron in plant foods is less readily absorbed by the body than that in animal foods. Vegan diets are likely to be low in protein, iron, calcium, riboflavin, vitamin B 12, and energy. Vitamin B 12 is only found in animal foods, so supplementation of this vitamin is essential, and supplementation of the other nutrients would probably be necessary. Vegetarian diets that include dairy products and eggs tend to be nutritionally similar to those containing meat, although they are probably lower in iron.

An awareness of several issues may aid early childhood educators in feeding vegetarian children. Children may not be willing or understand the need to eat certain foods in certain combinations to get enough protein. Many parents may not be aware of the need to combine plant proteins or know food combinations, in which case a child's growth could be compromised. Because protein plant foods are high in bulk, it may be difficult for children to eat the quantity of plant foods they need to get enough protein.

Vitamin supplements

The most common nutritional myth to take over the minds of Americans today is that good health can be achieved by taking vitamin and mineral pills, and that the consumption of supplements

somehow makes up for an otherwise bad diet. Vitamins are not the only nutrients the body needs and cannot substitute for any of the other nutrients.

Most people, including children, can get all the nutrients they need from food just by choosing varied diets. The once-a-day vitamin and mineral supplements probably aren't harmful to children, and the excess of water-soluble vitamins consumed is just washed away every day. The only purpose these supplements may be serving is to enrich the child's urine.

The belief that the more vitamins you take the healthier you will be can be dangerous, especially for children. Miracle cures are often attributed to large doses of single vitamins. Even though water-soluble vitamin excess is excreted, researchers aren't certain how the large doses of vitamins may affect the body. Too many fat-soluble vitamins and too much iron can be as toxic to children as the medications we so carefully keep from them.

Teaching our children that nutrition comes from vitamin and mineral pills can lead to a generation of pill poppers. It would seem wiser to teach children that the body gets its nourishment from good foods, not pills.

Organic foods

Organic foods are plant foods grown in soil to which chemical fertilizers have not been added, nor have herbicides or pesticides been used. Organic meat and dairy products come from animals raised on feeds grown organically and untouched by drugs such as hormones.

Are organic foods healthier than non-organic? They are not more nutritious. The method of growing a food affects the yield but not the nutritional quality. No dangers to health have been connected with the use of commercial fertilizers. To date the use of government approved herbicides and pesticides on food have not been proved to be hazardous, because the residue that may remain on food is such a small amount.

Peace of mind, however, is an element of good health. If people believe that non-organically grown foods are not as good for them as organic foods, there is certainly no reason why they shouldn't eat organic foods. Most organic foods are grown on a small scale basis and are more expensive than foods found in the supermarket. Since they are not grown for long supermarket shelf life, organic vegetables offer tastier but more perishable varieties.

Natural foods & food additives

Modern marketing practices — supermarkets and the shipping of foods across the country — require the use of chemicals added to the foods to lengthen their shelf life and prevent spoilage. These are called intentional food additives.

The Food and Drug Administration maintains a list of food additives that are generally recognized as safe (GRAS), which means they have not been found to be toxic or harmful in

laboratory tests. Currently all food additives on the GRAS list are being reviewed.

Natural foods contain no additives. Often they are grown organically. Since they are foods in their natural state, there is no doubt that they are healthy. Even natural foods, however, can be potentially hazardous.

Members of the cabbage family contain antithyroid compounds. When very large quantities of these vegetables are consumed over an extended period, the antithyroid compounds contribute to the development of goiter. Probably the most important potentially harmful substances in food are the toxins produced by molds that naturally infect foodstuffs. Concerns about these toxins have led public health officials to warn individuals against eating moldy food.

Snacking

Snacking itself is not a bad habit, especially for preschoolers who often need several small meals a day instead of three large ones. What gives snacking a bad name are the junk foods typically chosen for snacks. Candies, cookies, soft drinks, and potato chips are all either loaded with sugar, fat, salt, or some of each. Besides offering few nutrients and excessive calories, these empty-calorie foods contribute to the kind of diet that is a risk for developing dental caries and obesity, and eventually atherosclerosis and hypertension. Foods high in fat also give a feeling of fullness to the eater and can interfere with a child's appetite for more healthy meals.

Snacks for children should be nutritious but not boring. Raw vegetables cut in interesting shapes with a low-fat dip of yogurt are nutritious as well as fun to eat. Raw fruits are sweet and juicy. A small portion of any good food can be a snack — slices of hard boiled egg or yogurt, for example.

Children & protein

Most American children, like most American adults, consume more than enough protein in their diets. Protein is an important nutrient for growth, but it is not magical. The body needs only as much protein as it can use. Any excess is stored as fat or burned as energy. Overconcern with eating protein can lead to the exclusion of other foods that supply needed nutrients, and it is hard on the food budget.

Some food myths

The chocolate in chocolate milk does not interfere with the absorption of calcium from milk. Chocolate has no effect on the nutritive value of milk, other than adding sugar and calories.

Honey is not more nutritious than sugar. The nutrients in honey are in such minute amounts that they contribute virtually no nutrition. Also, a tablespoon of honey has more calories than a tablespoon of granulated sugar.

Cream cheese is not a good source of calcium or protein, unlike other cheeses. Cream cheese is very high in fat.

Gelatin is not a good source of protein, because it lacks the essential amino acid tryptophan. The sweetly flavored gelatin products are high in sugar.

Bread is not fattening. One slice of whole wheat or enriched white bread contributes only 65 kilocalories. As a carbohydrate food, bread supplies the same amount of energy per gram as does protein. It's not the bread that's fattening, but the fats that are spread on it.

Influences on food habits

Healthy, hungry children will eat if given a calm atmosphere in which to do it (21). If food were simply something to eat, that might well be so. But in today's society food is entertainment; it is holidays; it is mother's love. Many of us associate certain foods with pleasant memories. We may also hate other foods even though we don't remember how they taste or whether we've ever even eaten them. Many of our attitudes about food stem from childhood experiences.

Once it was believed that if left on their own, young children would be able to choose enough nutritious food to stay healthy. This was the theory proposed by a Chicago doctor, Clara Davis. She studied the foods picked by three toddlers in the pediatric ward of a hospital. Since the children apparently ate well and did not develop deficiency diseases, Dr. Davis concluded that all young children have the instinct to choose good foods. This theory is still believed by some health professionals today.

Today's children are exposed to far different conditions than the hospital children of 1928. Candy, fast foods, presweetened cereals, and soda pop were not common in 1928. Nor were 1928 children exposed to the television commercials that influence today's children. Dr. Davis presented her three toddlers with only nutritious foods from which to choose, so obviously they only chose nutritious foods.

Family

Parents, both consciously and unconsciously, influence what their children will eat. From the first feeding an infant is learning attitudes about food. Whether the mother is relaxed or tense, flexible or rigid, she fairly accurately passes on to her children the attitudes about food that she herself has learned.

The mother is usually the one who decides what foods are served because she is often the one who buys the food. She has been called a "gatekeeper," controlling what foods come into the household, and in that way influencing a child's exposure to foods (22). She is often the adult who prepares the food and is present when the young child eats.

The father also influences family food patterns. His ideas about raising children influence the mother's behavior as well as his own. How he acts at the table and the foods he chooses to eat serve as models for the children to imitate. One study of the father's influence on food preferences of young children found that children often liked or disliked the same vegetables as their fathers (23). But these researchers also found that foods disliked by the father were not often served. The father's main influence on his child's eating behavior seemed therefore to be limiting the variety of foods served in the home.

The ability to eat wisely is not an inborn instinct in humans. Children learn about what is or isn't eaten by observing others and then modeling their behavior after what they've seen. If children see their parents reject certain foods, they will likely reject the same foods. They are also more apt to accept new or different foods if

they see a familiar adult eating the same food. This modeling behavior was illustrated in a California study in which children were presented with filled blue tortillas for lunch. If the mothers sat down and ate similar blue tortillas, the children were much more likely to eat them than if the mothers simply offered the food (24).

Older brothers and sisters have an even greater influence on food choices of younger children than do parents (25). Outside the home, in nursery schools and other care centers, peer pressure asserts a strong influence on food children will eat. If offered a choice, a child will likely pick the same food that he/she saw another child pick (26).

Taste

All these influences are external to the food itself. How much taste influences what a child will eat is really not known. Since eating is an experience rich in sensory stimulation, it seems likely that the sight, smell, sound, feel, and taste of foods influence a child's reaction to them.

A preference for a sweet taste is present early in life. Newborn infants will suck harder for and consume more sweetened water than plain water (27). The sweet preference is still evident in early childhood, but there is some evidence that it begins to fade by age four (28). Since overconsumption of sweet foods can lead to health problems, exposure to sweet foods should be limited.

Other taste preferences seem to be acquired, not inborn. Infants will accept equal amounts of salted and unsalted foods, showing that a salty taste is neither preferred nor rejected (29). Sour and bitter tasting foods are more readily accepted by children who have been exposed to those tastes early in life than by those who have not (30). As long as the possibility exists that early taste experiences may influence food preferences, it would be wise to expose children to a wide variety of tastes early in life.

Television advertising

Modern technology has created another influence on a child's developing food habits — television. Today's children watch a lot of TV. Preschoolers are likey to watch about 26.5 hours of television a week (31). Besides the obvious effect such sitting and watching has on limiting physical activity, television also affects the food choices a child makes.

Both subtly and openly, television advertising sends children messages about what is good food to eat. Unfortunately, the message preschoolers are getting is that if it's sweet, it's good. Presweetened breakfast cereals are the most heavily promoted foods, with candies and other sweets ranking second (32). TV not only shows kids what foods are fun and, by implication, therefore good to eat but also implies that foods that are not advertised (vegetables, fruits, meats, breads, dairy products — in short, all nutritious foods) are not good to eat.

The message gets through even to young children. A California study found that the more often children are exposed to television commercials pushing sweet foods, the more they will choose these foods for snacks and meals, if given the choice (33). By observing preschoolers at supermarkets with their mothers, it has been found that the foods children request or demand their mothers to buy most are those most heavily advertised (34). Children's demands for these foods are more often approved than rejected by their parents. When rejected, conflict arises between the parent and child (35). Many parents believe one of their biggest problems in raising children is trying to deal with demands for foods kids have seen advertised on TV (36). Although parents can control the effect of television advertising on children by monitoring what they watch, by commenting on what they see, or by simply turning the set off, few parents want the embarassment of arguing with a screaming five year old in the crowded aisles of a supermarket.

The California study tried to find out whether television advertisements also could have a positive effect on food choices, by encouraging children to eat nutritious foods. They exposed five and six year olds to pro-nutrition public service announcements and found that those who viewed the PSAs chose more nutritious foods for snacks than did those children who saw the TV commercials or children who saw neither. What had most effect on influencing children to choose nutritious foods was a cartoon character (Fat Albert) in a 30-minute program showing the negative effects of junk foods. Researchers speculate that familiarity with the advertisement or program plays a role in how much a message can influence young viewers. The nutrition PSAs were new to the children and had less influence on their food choices than did familiar TV commercials or a well-known Saturday morning cartoon character.

The regulation of television advertising directed at children is currently under discussion at the Federal Trade Commission. If philosophical arguments about freedom of the press (whose responsibility it is, etc.) are pushed aside, what remains is the fact that one reason children choose to eat sweetened foods is that television tells them to.

Preschoolers' eating behavior

Are preschoolers problem eaters? Many parents seem to think so and are especially concerned that their children are not eating enough, that they dawdle over food, and that their appetites are erratic (37). Unfortunately, adults can't remember what being a preschooler was like and often misinterpret a child's behavior.

Children who refuse to eat aren't necessarily being ornery. Perhaps they just aren't hungry. Preschoolers' growth rate is slowing down from that of infancy, and they don't need as much food as they did in their first year. Sometimes a child is ravenously hungry at one meal and eats second and third helpings. Then the child isn't very hungry at the next. Also, a child who is overtired may not wish to eat. Or maybe the child is just trying to assert his or her independence, having learned the word "no" and wanting to try it out.

Whatever the reason for lack of appetite, a child should not be forced to eat if he or she isn't hungry. Parents who cajole, nag, bribe, or threaten children to eat turn what would be a relaxed, pleasant time into a tense battleground. It is the tug-of-war over eating, not the child, that creates the problem eaters among preschoolers.

Other adult practices can cause problems with young children's eating habits. Adults often heap large amounts of food on a plate, expecting the child to eat it. This sets an insurmountable task for the child, who may choose to eat nothing instead of tackling the pile. Serve small amounts of food that a child can easily eat and that will give a sense of satisfaction when finished. If he or she is still hungry and knows there's more food, the child will ask for it.

Adults take the activity involved in eating for granted, but it's a complex skill for preschoolers to learn. Handling utensils, bringing food to mouth, chewing, swallowing, and socializing can be overwhelming tasks for a hungry child. It's no wonder that preschoolers like to eat with their fingers. Many foods can be prepared and served as finger foods. It isn't "bad manners" for a child to eat this way but part of exploring the foods — their feel and texture as well as their taste and appearance. Children will want to learn to use utensils simply because they see adults using them. Much spilled food can be expected in the process.

Even though all children are different, some generalizations can be made about typical eating behaviors among preschoolers. For instance, food jags are common. A child may demand a banana at every meal for days. As long as the child eats other foods besides the demanded one, there is no harm in humoring the child until the food jag ends. The likes and dislikes of young children are very changeable. A favorite food can easily fall out of favor.

Vegetables seem to be the least liked food among preschoolers. Often what they object to, though, is not the vegetable, but the form in which it is served, its texture, or a strong taste. Children will sometimes eat raw vegetables that are unacceptable to them when cooked. Sometimes a different method of cooking the vegetable will make it more acceptable. As one nutritionist put it, try changing the vegetable, not the child (38).

Preschoolers do like to eat, especially when foods are attractive and varied in color and texture. One experienced nutritionist recommends serving one crisp, one soft, and one chewy food at each meal (39). Young children like foods at room temperature so that they don't have to wait for hot foods to cool, or cold foods to warm. They prefer simple foods, plain and unmixed, over combination foods. Simplicity in foods should not be confused with sameness in foods. Constant repetition of the same foods is as boring for children as it is for adults. Dry foods are hard for children to chew and swallow. Before age six, most children haven't mastered the skill required to cut meats and should be served bite-sized chunks or meats cut into slices for finger foods.

Children learn to like a food by frequent exposure to it. When a new food is introduced, a child may choose to only look at it, or just pick it up and feel it, which is fine. The natural curiosity of children is a benefit when new foods are tried. The next time the food is served, the child may take a tiny bite. Often preschoolers will claim to dislike a food, yet eat it when it is served again or in a different way. Children who have been exposed to a food, even though they claim to dislike it, will be more apt to try it again than will children who have never tried the food before (40).

Educators' role in developing good food habits

Mothers whose children attended a nursery school in New Mexico were surprised when their preschoolers began asking them to buy turnips, bell peppers, and cauliflower (41). Many of the children had refused these foods when the mothers had tried to introduce them at home. The mothers wondered what the secret of the nursery school's success was.

It is often easier to get children to eat different foods in a group-feeding setting. Away from any parent-child conflicts over food that might exist at home, preschoolers may see their friends enjoying a food they disliked and decide maybe it isn't so bad after all.

In this setting, early childhood educators can work wonders with the eating habits of young children. If they take the time to question parents about what foods the children eat at home, they can supplement the child's diet at the center, besides introducing new foods. This is especially important for children of low-income families.

Caregivers who just carry plates of food from the kitchen and place them before the children may provide nutritious meals, but they do nothing to help the children eat the food. They also do not realize their important role in helping children learn about foods and establishing dietary habits that could positively affect the children's health throughout life.

Many studies have been conducted in nursery schools and day care centers to find ways to get children to eat a greater variety of nutritious foods, especially vegetables. Most children eat better in a "family-style" setting. In family service, an adult serves the food and eats at a table with a group of children. There are several advantages. The children can follow the example of the adult eating with them. If the adult encourages some conversation, children can learn about a social behavior while eating. If the children help determine how large their servings will be, they feel more responsibility to finish the food. Often even two year olds can pour their own milk from a small pitcher. The adult can also guide children to accept new foods.

Different methods of encouraging children to try new foods work with different children in differing degrees (42). Some children will try new foods if an adult simply instructs them to do so, whereas without instruction they would not taste the food (43). Consistently praising desired eating behavior while ignoring undesirable behavior is a widely proved method of getting children to eat (44,45). Much bad behavior at eating times stems from a child's desire for attention. If the attention is denied, children will soon stop misbehaving and turn their attention to the behavior that gets praise. One study carried this positive reinforcement of desired behavior one step further by offering token awards when children finished a portion of a new food (46). The reward system was quite effective.

The key to success lies in how the adult handles the eating situation. If the adult maintains a casual attitude while eating a new food, the children are likely to follow suit. There is certainly no

reason why a child **has** to eat a certain food on any particular day. When children learn that they will not be forced to eat any food, they will feel more like trying it. One nutritionist found that telling children that they don't have to like a food, but just learn to eat it, increases their willingness to try the food (47).

Nutrition education in preschool centers

Getting children to eat more of the nutritious foods they are served is one step early childhood educators can take to help children develop good eating habits. Nutrition education, a second step, should begin in the preschool years. It is much easier to establish good eating habits than to change poor ones. Learning good nutrition early in life will affect food choices later in life. The adult's nutritional status may have its roots in the habits being formed in the preschool years.

Nutrition education in child care centers can take advantage of countless teaching opportunities. Questions, such as where does milk come from? how do peanuts get to be peanut butter? how do tomatoes grow? arise from children's natural curiosity about the world around them.

Nutrition education may be missing from preschool centers for many reasons. Some caregivers may feel nutrition is a subject too complicated for preschoolers to understand. Others may feel they do not have the necessary nutrition or scientific background to even attempt the subject. All they may remember from their childhood about nutrition education is charts of food groups. Or they may believe that nutrition belongs in the hands of food preparers in the kitchen.

Caregivers who feel this way do not realize the concepts involved in nutrition education. In the process of discovering which foods are good for them and which are not, children learn language skills, gain coordination, and learn about the environment as well as nutrition.

You don't have to be a nutritionist to teach nutrition to children. No one would expect a preschooler to understand the chemical functions of vitamins in the body. What they **can** learn is that food comes from a variety of sources and that we need to eat a variety of foods; that foods have different textures, shapes, colors, smells, and tastes. They can be taught to try new foods and to develop positive attitudes about mealtime.

Food activities

The benefits obtained from involving children in discussing and preparing foods for snacks and meals are many. When children prepare the food themselves, an air of enthusiasm, anticipation, and fun is generated so that the children often can't wait to taste the finished product. In the process of preparing foods, children can learn about foods — how they feel and look and smell; where they come from; why they're good to eat. They can learn about different countries and different customs. They can learn to handle kitchen tools and increase their skills in using utensils.

Nutrition education does not have to include cooking, though of course it can. Food activities also can involve storytelling, plays, songs, and puppet shows about foods.

It is important that the adult do preparations that need adult skills and then leave the children free to work with the food without being told they're doing something wrong. The appearance of the

end product is not important. Foods that have been burned or undercooked, soggy sandwiches, and watery pudding are successful flops. If children have made the food themselves, they'll probably enjoy eating it, no matter how it looks.

Food projects must be well planned so that the atmosphere stays calm and relaxed. The projects must be simple and within the children's capabilities so they don't get impatient and frustrated and thus lose interest.

Foods should be nutritious and made from "scratch." Convenience foods should be avoided because they don't offer as many learning possibilities. For example, biscuits made from flour, water, etc., involve measuring, sifting, mixing, rolling, shaping, and baking. Refrigerated dough needs only to be shaped and baked.

Enough equipment should be on hand so that everyone who wants to participate can. On the other hand, children should not be forced to take part. If a child doesn't want to help prepare the food, he or she should be encouraged to just watch. Chances are the excitement of the other children will draw the watcher in.

Involving food preparation workers

Who could better show children about preparing food than the people who make the children's meals? Yet food preparation workers are often left out of nutrition education activities because they are thought to be too busy or uninterested. Helping with food activities can be a rewarding change of pace for cooks. They might enjoy seeing the children's excitement about food.

Involving food preparers could simply mean bringing the children into the kitchen to see how lunch is prepared. Or food preparers can help in classroom activities — assisting and explaining to the children how to use equipment, for example.

Food preparation workers may become interested enough in the children's nutrition education activities to meet with workers of other centers to exchange experiences and ideas. In this way, not only the children but also the food preparers are receiving nutrition education.

The ultimate success of any nutrition education program comes when children carry their enthusiasm home. Since parents and the home environment influence a child's eating behavior, fathers and mothers should be invited to participate in food activities. This gives them the opportunity to learn more about good nutrition and perhaps see what their children will eat in another setting. Often parents are surprised to learn just how much their child is capable of doing.

Even though parents may not seem interested in nutrition education activities, they are concerned about what foods their children are served. A nutrition committee to plan snacks and meals formed of parents, teachers or caregivers, food preparation workers, administrators, and even children can be a good starting

place for nutrition education. Parent interest also can be sparked by posting or sending home the month's menus. When parents see what their children are eating at the center, they may want to try some of the new foods at home.

After parents' interest is kindled, parents on the nutrition committee might be willing to assist in classroom food activities, nutrition field trips, or in planning nutrition workshops for other parents.

If parent interest in nutrition is heightened as the children become acquainted with a wide variety of foods, the good eating habits learned at the centers will be continued at home (48).

The preschool years are the training ground for the quality of diet in later life (49). Caregivers who recognize the unique opportunity they have can not only improve the nutritional status of children in their care but also help children to learn how to make healthy food choices that will benefit them throughout life.

References

1. P. V. V. Hamill and W. M. Moore. Contemporary growth charts: Needs, construction and application. **Dietetic Currents** 3(5): 1976.
2. S. J. Fomon. **Nutritional Disorders of Children.** DHEW Pub. No. (HSA)78-5104. U. S. Dept. of Health, Education and Welfare, Public Health Service, 5600 Fishers Lane, Rockville, MD, 1978. p. 100.
3. Agricultural Research Service. **Nutritive Value of Foods.** Home and Garden Bulletin No. 72. Superintendent of Documents. U.S. Government Printing Office. Washington, DC 20402, 1972.
4. Fomon, **Nutritional Disorders,** p. 112.
5. Ibid, p. 100.
6. Ibid, p. 64.
7. W. B. Weil. Current controversies in childhood obesity. **Journal of Pediatrics** 91 (2): 175, 1977.
8. T. J. Coates and C. E. Thorensen. Treating obesity in children and adolescents: A review. **American Journal of Public Health** 68(2): 143, 1978.
9. Coates, Treating obesity.
10. Ibid.
11. Fomon, **Nutritional Disorders,** p. 93.
12. B. F. Feingold. **Why Your Child Is Hyperactive.** New York: Random House, 1975.
13. B. F. Abrams, **et al.** Pershectives in clinical research: A review of research controversies surrounding the Feingold Diet. **Family and Community Health** 1(4): 93, 1979.
14. C. M. Olson. Hyperactivity: A diet for Peck's bad boy? **Human Ecology Forum** 6(4): 20, Spring 1976.
15. D. M. Paige, **et al.** Lactose malabsorption in preschool black children. **American Journal of Clinical Nutrition** 30: 1018, 1977.
16. Fomon, **Nutritional Disorders,** p. 79.
17. P. T. McEnery and C. A. Davis. Nonpharmacologic interventions in hypertension. **Pediatric Clinics of North America** 25(1): 127, 1978.
18. C. A. Nugent and L. L. Van Haldren. Diet and coronary heart disease. **Family and Community Health** 1(4): 93, 1979.
19. McEnery and Davis, Nonpharmacologic interventions.
20. P. L. Pipes. **Nutrition in Infancy and Childhood.** Saint Louis: C.V. Mosbey Co., 1977. p. 163.
21. Ibid., p. 98.
22. K. Lewin. Forces behind food habits and methods of change. **The Problem of Changing Food Habits.** NRC Bulletin No. 108. Washington, DC: National Academy of Science, 1943.
23. M. S. Bryan and M. E. Lowenberg. The father's influence on young children's food preferences. **Journal of the American Dietetic Association** 34: 30, 1958.
24. L. V. Harper and K. M. Sanders. The effect of adults' eating on young children's acceptance of unfamiliar foods. **Journal of Experimental Child Psychology** 20: 206, 1975.
25. E. S. Eppright, **et al.** Eating behavior of preschool children. **Journal of Nutrition Education** 1: 16, 1969.
26. K. Duncker. Experimental modification of children's food preferences through social suggestion. **Journal of Abnormal and Social Psychology** 33: 489, 1938.
27. J. A. Desor, O. Maller, and L. S. Greene. Preference for sweet in human infants, children and adults. In: **Taste and Development.**

References

The Genesis of Sweet Preference. DHEW Pub. No. (NIH) 77-1068. Bethesda, Maryland: Public Health Service, 1977.

28. K. Montanaro and C. Olson. **Preschoolers' Taste Sensitivity and Preference for Sucrose.** Unpublished manuscript, 1978.
29. Pipes, **Nutrition in Infancy,** p. 163.
30. H. W. Moskowitz, **et al.** Cross-cultural differences in simple taste preferences. **Science** 190: 1217, 1975.
31. **Research on the Effects of Television Advertising on Children.** Washington, DC: National Science Foundation, 1977. p. 12.
32. C. M. Olson. Television advertising of food and its impact on children. **Professional Perspectives.** Division of Nutritional Sciences, Cornell University, Ithaca, NY, September 1978.
33. J. Galst and M. White. The unhealthy persuader: The reinforcing value of television and children's purchase-influencing attempts at the supermarket. **Child Development** 47: 1089, 1976.
34. Olson, Television advertising.
35. C. Atkin. Effects of television advertising on children — parent-child communication in supermarket breakfast selection. Report No. 7. Michigan State University, June 1975.
36. **General Mills American Family Report 1976-1977. Raising Children in a Changing Society.** Minneapolis: General Mills, 1977.
37. Eppright, Eating behavior.
38. M. E. Lowenberg. Food preferences of young children. **Journal of the American Dietetic Association** 24: 430, 1948.
39. Pipes, **Nutrition in Infancy,** p. 94.
40. S. M. Close and J. Sabry. An experiment to influence vegetable acceptance of nursery school children. **Journal of the Canadian Dietetic Association** 39(3): 221, 1978.
41. A. Glaser. Building food acceptances in nursery school children. **Journal of Home Economics** 49(1): 47, 1957.
42. J. S. Hall and M. C. Holmberg. The effect of teacher behaviors and food serving arrangements on young children's eating in a day care center. **Child Care Quarterly** 3(2): 97, Summer 1974.
43. Ibid.
44. C. L. Ireton and H. A. Guthrie. Modification of vegetable-eating behavior in preschool children. **Journal of Nutrition Education** 4: 100, Summer 1972.
45. R. Highberger and L. Corothers. Modification of eating behavior of toddlers in a day care setting. **Home Economics Research Journal** 6(1): 48, 1977.
46. Ireton, Modification of vegetable-eating.
47. Glaser, Building food acceptances.
48. N. Ferreira, Teachers' guide to educational cooking in the nursery school—an everyday affair. **Young Children** 23, November 1973.
49. N. R. Beyer and P. M. Morris. Food attitudes and snacking patterns of young children. **Journal of Nutrition Education** 6: 131, 1974.

Additional references

L. A. Barness. American Academy of Pediatrics, Committee on Nutrition. Nutritional aspects of vegetarianism, health foods and fad diets. **Nutrition Reviews** 35(6): 153, 1977.

Committee on Nutrition, American Academy of Pediatrics. Salt intake and eating patterns of infants and children in relation to blood pressure. **Pediatrics** 53(1): 115, 1974.

I. Harrill, **et al.** Food acceptance and nutrient intake of preschool children. **Journal of Nutrition Education** 4: 103, Summer 1972.

M. McWilliams. **Nutrition for the Growing Years.** 2nd ed. N.Y.: John Wiley and Sons, Inc., 1975.

E. A. Martin, and V. A. Beal. **Roberts' Nutrition Work with Children.** 4th ed. Chicago: University of Chicago Press, 1978.

N. Munro. A review of the 1928 research by Clara Davis, "Self Selection of Diet by Newly Weaned Infants." **Journal of Home Economics** 58 (8): 655, 1966.

National Dairy Council. **Nutrition Source Book,** Rosemont, IL, 1978.

R. E. Rockwell, and J. Endres. Nutrition in day care centers. **Young Children,** October, 1969. p. 20.

I. Valadian, and D. Porter. **Physical Growth and Development from Conception to Maturity.** Boston: Little, Brown and Co., 1977.

I. B. Vyhmeister, and L. Sonnenberg. Safe vegetarian diets for children. **Pediatric Clinics of North America** 24(1): 203, February 1977.

Appendix A

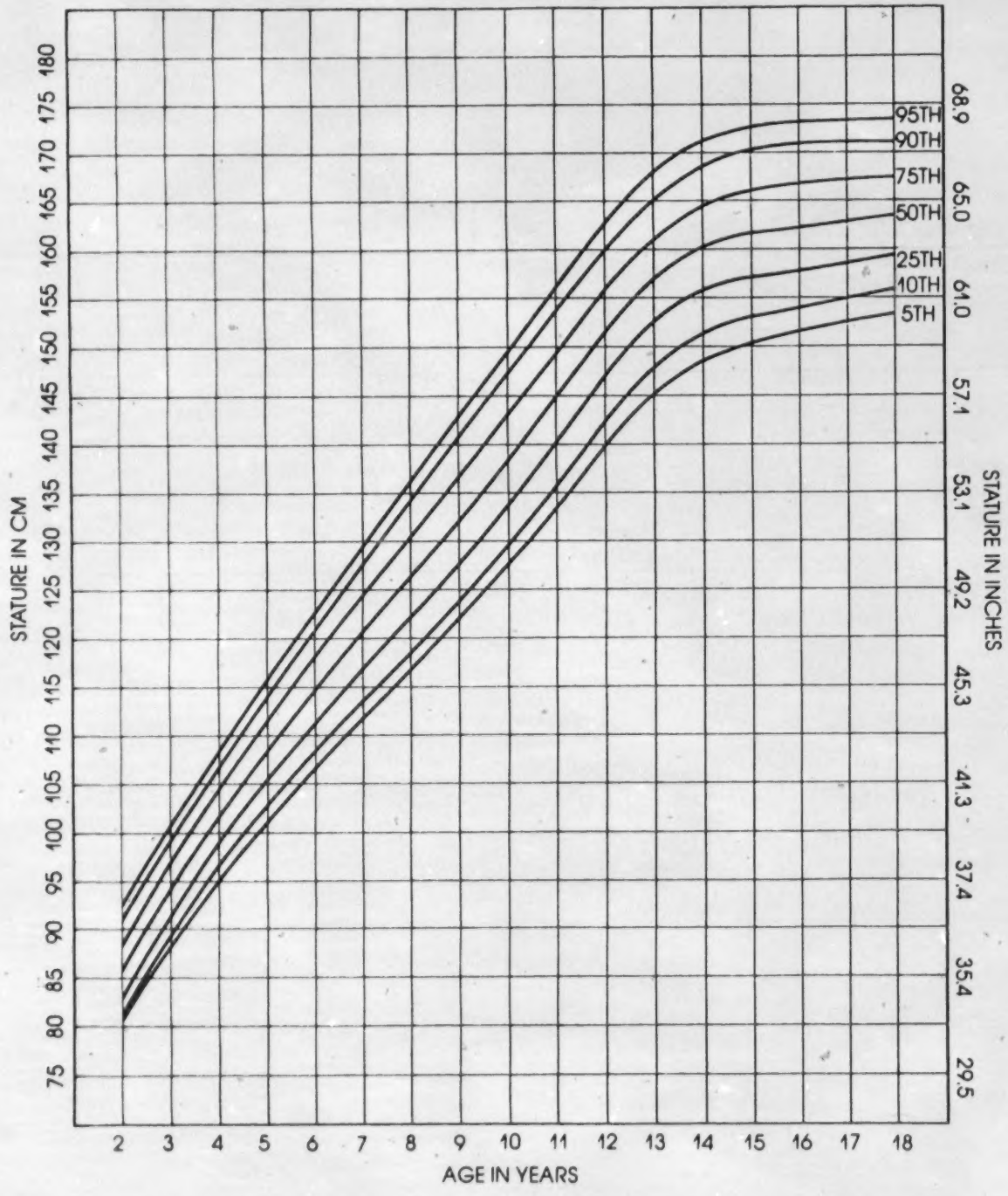
National center for health statistics growth charts

Measurements of each age-sex group are ranked by size and assigned percentiles according to position in the rank. The chart contains 7 percentile levels for comparison purposes, the 5th, 10th, 25th, 50th, 75th, 90th and 95th. The 50th percentile level is the middle value. A girl who is found to be at the 25th percentile for weight and stature is smaller than 75 out of every 100 girls her age. Conversely a girl whose measurements are at the 75th percentile for weight and stature is smaller than only 25 of every 100 girls her age. Measurements between the 25th and 75th percentiles can be considered normal growth. Measurements between the 10th and 25th and between the 75th and 90th percentiles may be normal growth for an individual if the child consistently shows a pattern of growth at those percentiles. Measurements below the 10th and above the 90th percentiles could signal the need for more intensive assessment. Other signals for further investigation include a shift of more than 2 percentile levels in any one measurement or a discrepancy of more then 2 percentiles between height and weight measurements. Obesity may be suggested when, for example, height is found to be at the 25th percentile and weight is above the 75th. Obesity also may be indicated when weight for height is greater than the 95th percentile. Conversely, the charts can also signal the possibility of undernutrition because of low weight for height measurements.

The growth standards are a valuable tool in assessing nutritional health when properly used. Height and weight measurements alone cannot lead to a diagnosis of a nutrition problem but can serve as an indicator that a condition warrants closer attention.

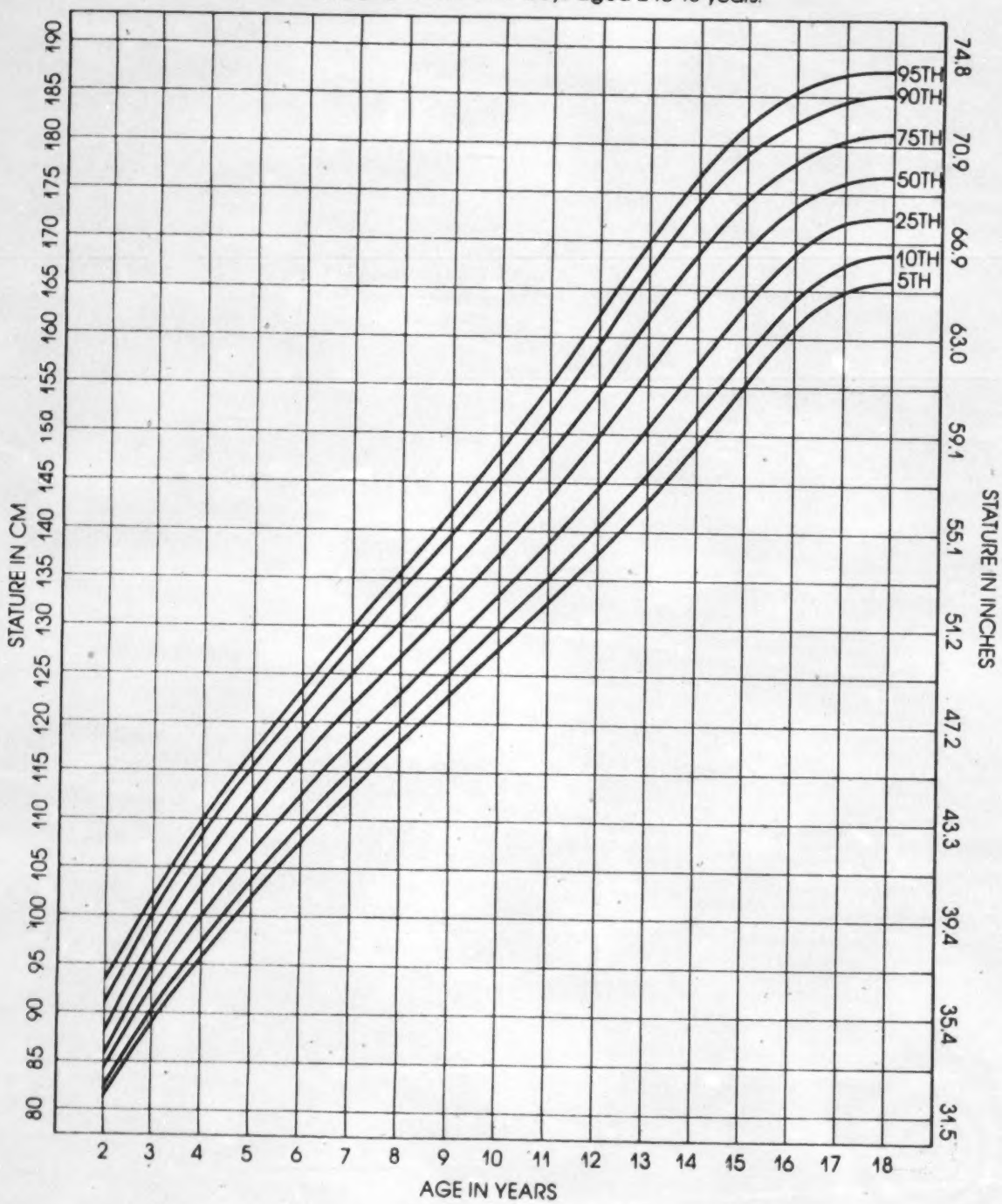
NATIONAL CENTER FOR HEALTH STATISTICS

Stature by age percentiles for girls aged 2 to 18 years.

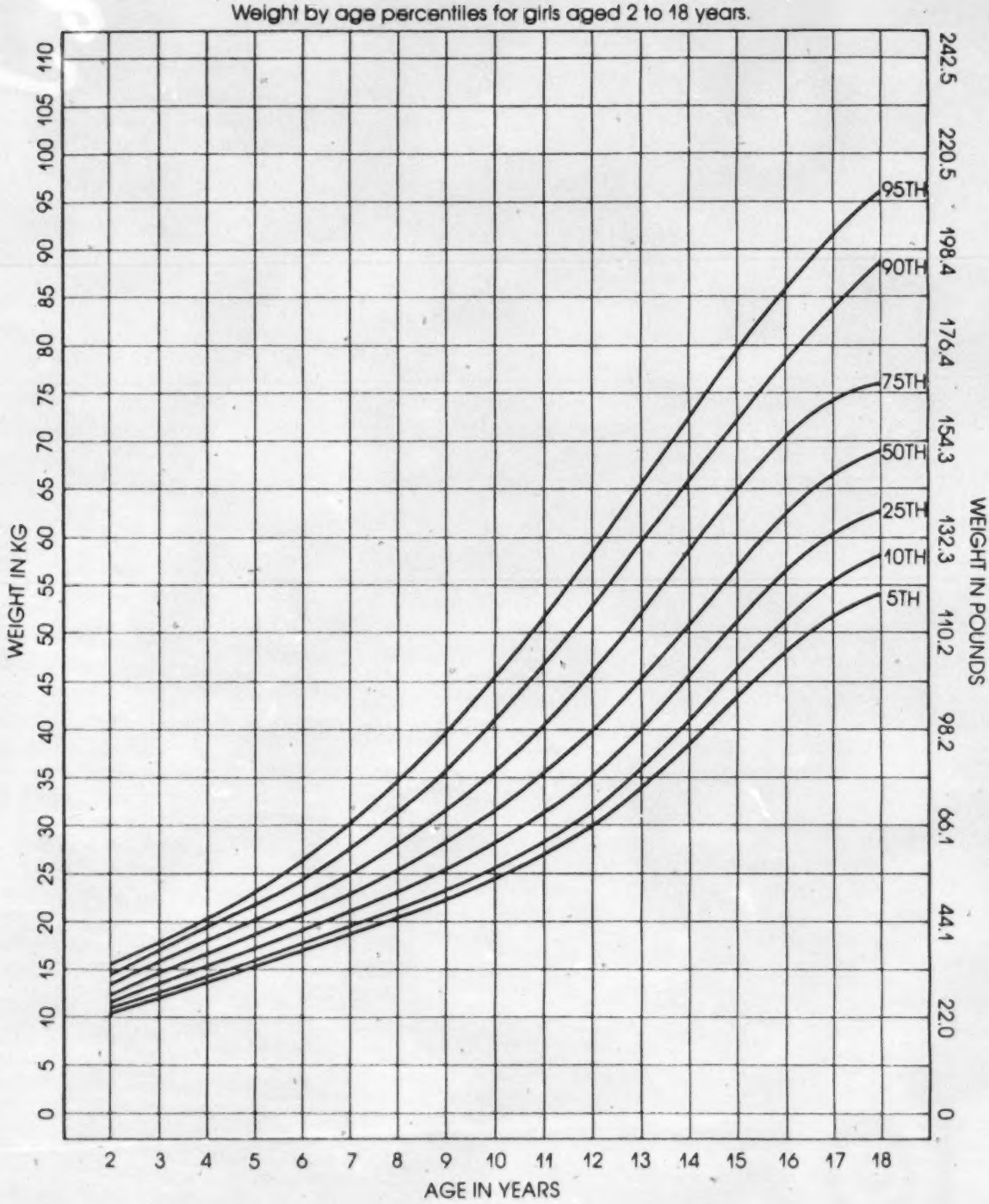


NATIONAL CENTER FOR HEALTH STATISTICS

Stature by age percentile for boys aged 2 to 18 years.

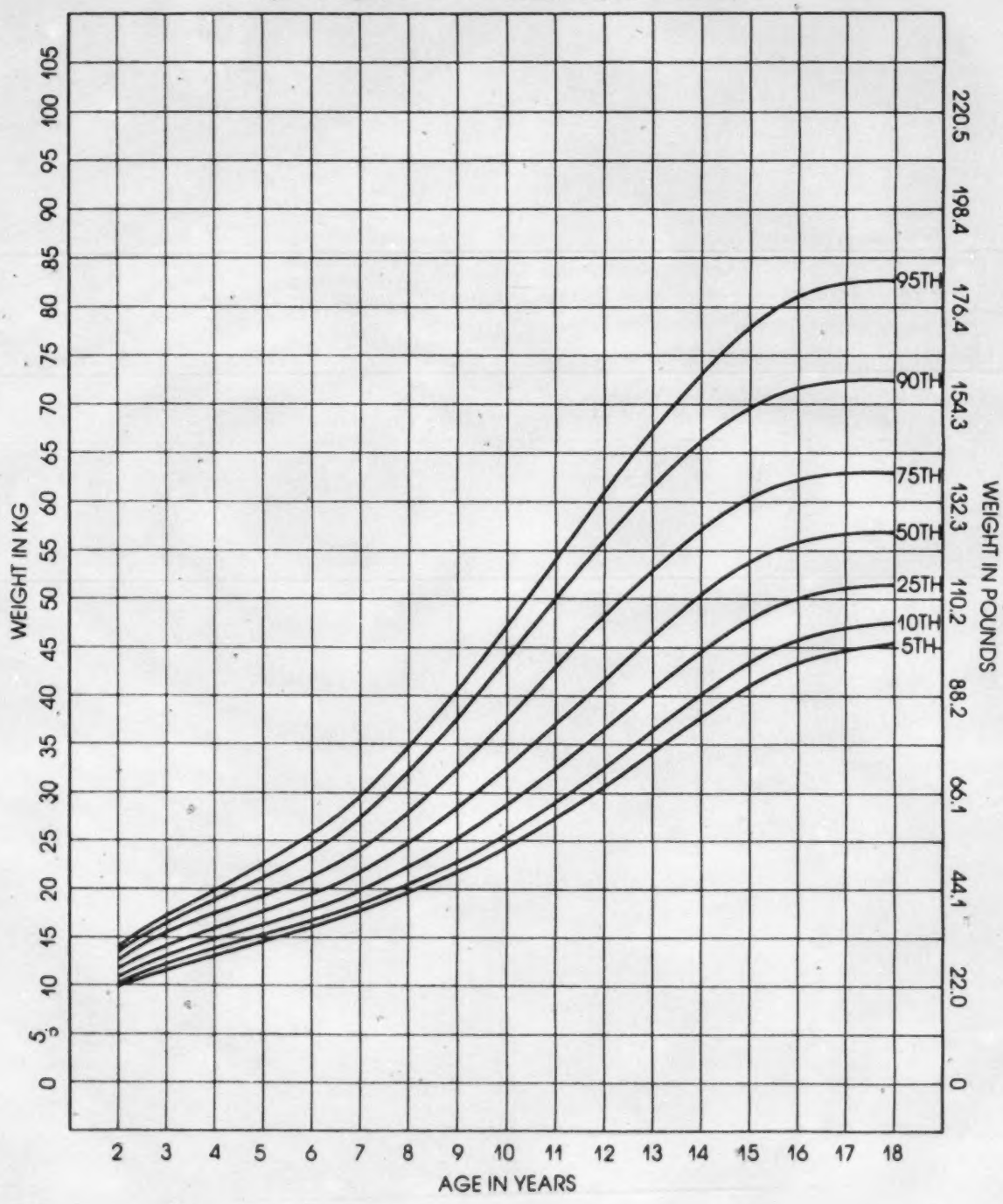


NATIONAL CENTER FOR HEALTH STATISTICS



NATIONAL CENTER FOR HEALTH STATISTICS

Weight by age percentiles for boys aged 2 to 18 years.



Appendix B Leader nutrients

From: National Dairy Council, **Nutrition Source Book.** Rosemont, IL, 1978.

Nutrient	Important Sources of Nutrient	Some Major Physiological Functions		
		Provide Energy.	Build and maintain body cells.	Regulate body processes.
Protein	Meat, Poultry, Fish Dried Beans and Peas Egg Cheese Milk	Supplies 4 Calories per gram.	Constitutes part of the structure of every cell, such as muscle, blood, and bone, supports growth and maintains healthy body cells.	Constitutes part of enzymes, some hormones and body fluids, and antibodies that increase resistance to infection.
Carbohydrate	Cereal Potatoes Dried Beans Corn Bread Sugar	Supplies 4 Calories per gram. Major source of energy for central nervous system.	Supplies energy so protein can be used for growth and maintenance of body cells.	Unrefined products supply fiber—complex carbohydrates in fruits, vegetable, and whole grains—for regular elimination. Assists in fat utilization.
Fat	Shortening, Oil Butter, Margarine Salad Dressing Sausages	Supplies 9 Calories per gram.	Constitutes part of the structure of every cell. Supplies essential fatty acids.	Provides and carries fat-soluble vitamins (A, D, E, and K).
Vitamin A (Retinol)	Liver Carrots Sweet Potatoes Greens Butter, Margarine		Assists formation and maintenance of skin and mucous membranes that line body cavities and tracts, such as nasal passages and intestinal tract, thus increasing resistance to infection.	Functions in visual processes and forms visual purple, thus promoting healthy eye tissues and eye adaptation in dim light.
Vitamin C (Ascorbic Acid)	Broccoli Orange Grapefruit Papaya Mango Strawberries		Forms cementing substances, such as collagen, that hold body cells together, thus strengthening blood vessels, hastening healing of wounds and bones, and increasing resistance to infection.	Aids utilization of iron.
Thiamin (B_1)	Lean Pork Nuts Fortified Cereal Products	Aids in utilization of energy.		Functions as part of a coenzyme to promote the utilization of carbohydrate. Promotes normal appetite. Contributes to normal functioning of nervous system.
Riboflavin (B_2)	Liver Milk Yogurt Cottage Cheese	Aids in utilization of energy.		Functions as part of a coenzyme in the production of energy within body cells. Promotes healthy skin, eyes, and clear vision.
Niacin	Liver Meat, Poultry, Fish Peanuts Fortified Cereal Products	Aids in utilization of energy.		Functions as part of a coenzyme in fat synthesis, tissue respiration, and utilization of carbohydrate. Promotes healthy skin, nerves, and digestive tract. Aids digestion and fosters normal appetite.
Calcium	Milk, Yogurt Cheese Sardines and Salmon with Bones Collard, Kale, Mustard, and Turnip Greens		Combines with other minerals within a protein framework to give structure and strength to bones and teeth.	Assists in blood clotting. Functions in normal muscle contraction and relaxation, and normal nerve transmission.
Iron	Enriched Farina Prune Juice Liver Dried Beans and Peas Red Meat	Aids in utilization of energy.	Combines with protein to form hemoglobin, the red substance in blood that carries oxygen to and carbon dioxide from the cells. Prevents nutritional anemia and its accompanying fatigue. Increases resistance to infection.	Functions as part of enzymes involved in tissue respiration.

Appendix B

Other important nutrients

From: National Dairy Council,
Nutrition Source Book.
Rosemont, IL, 1978.

Nutrient	Important Sources of Nutrient	Some Major Physiological Functions
Vitamin D **The Sunlight Vitamin**	Vitamin D Milk Fish liver oils Sunshine on skin (not a food)	Helps absorb calcium from the digestive tract and build calcium and phosphorus into bone.
Vitamin E	Vegetable oils Green leafy vegetables Whole grain cereals Wheat germ Egg yolk, butter, milkfat	Protects vitamin A and unsaturated fatty acids from destruction by oxygen. Exact biochemical mechanism by which it functions still unknown.
Vitamin B_6	Beef liver, pork, ham Soybeans, lima beans Bananas Whole grain cereals	Assists in red blood cell regeneration. Helps regulate the use of protein, fat, and carbohydrate.
Folic Acid **(Folacin)**	Green leafy vegetables Liver, dry legumes, nuts Whole grain cereals Some fruits, as oranges	Assists in normal blood formation. Helps enyzme and other biochemical systems function.
Vitamin B_{12}	Only in animal foods— Liver, meat, fish, shellfish Milk, milk products Eggs, poultry Vegetarian diets should include milk or a B_{12} supplement.	Assists in the maintenance of nerve tissues and normal blood formation.
Biotin **(No RDA-NRC)**	Kidney and liver Milk and eggs Most fresh vegetables	Helps regulate the use of carbohydrate. Assists body in forming and using fatty acids.
Pantothenic Acid **(No RDA-NRC)**	Liver, kidney, egg yolk Meat, milk Whole grain cereals, legumes	Helps regulate the use of carbohydrate, fat, and protein for the production of energy.
Phosphorus	Milk and milk products Meat, poultry, fish, eggs Whole grain cereals Legumes	Combines with calcium to give bones and teeth strength. Helps regulate many internal activities of the body.
Iodine	Seafoods Iodized salt	Helps regulate the rate at which the body uses energy.
Magnesium	Legumes, whole grain cereals Milk, meat, seafood Nuts, eggs Green vegetables	Helps regulate the use of carbohydrate and production of energy within the cells. Helps nerves and msucles work.
Zinc	Meat, liver, eggs, oysters Other seafoods, milk Whole grain cereals	Becomes part of several enzymes and insulin.
Copper **(No RDA-NRC)**	Seafood, meat, eggs, legumes Whole grain cereals Nuts, raisins	Assists with iron storage and its release to form red blood cells.

Appendix C
Recommended dietary allowances

Food and Nutrition Board, National Academy of Sciences-National Research Council
Designed for the maintenance of good nutrition of practically all healthy people in the U.S.A.

	Age (years)	Weight		Height		Energy	Protein	Fat Soluble Vitamins: Vitamin A Activity		Vitamin D	Vitamin E Activity[e]
		(kg)	(lbs)	(cm)	(in)	(kcal)[b]	(g)	(RE)[c]	(IU)	(IU)	(IU)
Infants	0.0-0.5	6	14	60	24	kg x 117	kg x 2.2	420[d]	1,400	400	4
	0.5-1.0	9	20	71	28	kg x 108	kg x 2.0	400	2,000	400	5
Children	1-3	13	28	86	34	1300	23	400	2,000	400	7
	4-6	20	44	110	44	1800	30	500	2,500	400	9
	7-10	30	66	135	54	2400	36	700	3,300	400	10

	Water-Soluble Vitamins							Minerals					
	Ascorbic Acid	Folacin[f]	Niacin[g]	Riboflavin (B_2)	Thiamin (B_1)	Vitamin B_6	Vitamin B_{12}	Calcium	Phosphorus	Iodine	Iron	Magnesium	Zinc
	(mg)	(μg)	(mg)	(mg)	(mg)	(mg)	(μg)	(mg)	(mg)	(μg)	(mg)	(mg)	(mg)
Infants	35	50	5	0.4	0.3	0.3	0.3	360	240	35	10	60	3
	35	50	8	0.6	0.5	0.4	0.3	540	400	45	15	70	5
Children	40	100	9	0.8	0.7	0.6	1.0	800	800	60	15	150	10
	40	200	12	1.1	0.9	0.9	1.5	800	800	80	10	200	10
	40	300	16	1.2	1.2	1.2	2.0	800	800	110	10	250	10

[a] The allowances are intended to provide for individual variations among most normal persons as they live in the United States under usual environmental stresses. Diets should be based on a variety of common foods in order to provide other nutrients for which human requirements have been less well defined. See text for more detailed discussion of allowances and of nutrients not tabulated. See Table I (p. 6) for weights and heights by individual year of age.*

[b] Kilojoules (kJ) = 4.2 x kcal

[c] Retinol equivalents

[d] Assumed to be all as retinol in milk during the first six months of life. All subsequent intakes are assumed to be half as retinol and half as β-carotene when calculated from international units. As retinol equivalents, three-fourths are as retinol and one-fourth as β-carotene.

[e] Total vitamin E activity, estimated to be 80 percent as α-tocopherol and 20 percent other tocopherols. See text for variation in allowances.*

[f] The folacin allowances refer to dietary sources as determined by **Lactobacillus casei** assay. Pure forms of folacin may be effective in doses less than one fourth of the recommended dietary allowance.

[g] Although allowances are expressed as niacin, it is recognized that on the average 1 mg of niacin is derived from each 60 mg of dietary tryptophan.

[h] This increased requirement cannot be met by ordinary diets; therefore, the use of supplemental iron is recommended.

*National Research Council, Food and Nutrition Board, 1974. **Recommended Dietary Allowances,** 8th rev. ed. Washington, D.C.; National Academy of Sciences.

Appendix D

From: A Guide to Nutritive Value

by Helen Gifft, Marcia Pimentel and Marjorie Washbon

This guide was designed to relate the nutritive value of food to individual nutritional needs and to compare the nutritive value of commonly eaten foods. The standard used for these comparisons is the U.S. Recommended Daily Allowance (U.S. RDA).

UNDERSTANDING THE U.S. RECOMMENDED DAILY ALLOWANCE (U.S. RDA)

The U.S. RDA is the standard used in nutrition labeling. It is based on the Recommended Dietary Allowances (RDAs) set by the National Research Council. The RDAs are judged by the Council to be adequate for nearly all healthy persons and generous for most.

U.S. RDA	
Protein	65 grams[1]
Vitamin A	5,000 International Units
Vitamin C	60 milligrams
Thiamin	1.5 milligrams
Riboflavin	1.7 milligrams
Calcium	1 gram
Iron	18 milligrams

Percent of U.S. RDA for Children

Ages	**4–6**
Protein	50
Vitamin A	50
Vitamin C	70
Thiamin	60
Riboflavin	65
Calcium	80
Iron	60

[1] 65 grams is the U.S. RDA for a mixed diet of animal and plant proteins; 45 grams is the U.S. RDA for a diet of mainly animal proteins: meat, fish, poultry, eggs, and milk.

NOTE: Tables 1 and 2 are adapted from **Nutrition Labeling; Tools For Its Use,** USDA, Agriculture Information Bulletin No. 382, 1975.

USING THE GUIDE

Percentages of the U.S. RDA are shown for seven major nutrients: protein, vitamin A, vitamin C, thiamin, riboflavin, calcium, and iron. Food energy is expressed as calories.

Percentages are given to the nearest 2% up to 10%; to the nearest 5% up to 50%; and to the nearest 10% above 50%. A dash indicates only a trace or none of the nutrient.

Numbers given are averages compiled from tables of food composition. When several foods are listed on the same line, the figures may not fit equally well all the foods included. Important differences are explained in footnotes.

Highly significant sources of a nutrient are indicated by boldface type in shaded areas. In general this designation is merited if a serving of food contains 10% or more of the U.S. RDA. Less than 10% is considered significant when more than one serving daily is common (for example, vitamin A in milk). Obviously, if the amount eaten is large enough, foods may be significant for some nutrients even though not shaded.

No shading is used in the iron column, because judging which foods are especially significant is more complex for iron than for other nutrients. The amount of iron absorbed from foods varies with the types of food eaten and the individual's need for iron. The U.S. RDA assumes an average availability of 10 percent of food iron. Present knowledge indicates that iron in meat, fish, poultry, and soybeans is **more** than 10 percent available; iron in eggs, whole grains, nuts, and dried beans is **less.**

The percentage of protein contributed by foods depends on whether the food comes from plants or animals. Animal protein is more efficiently used than plant protein. Thus 45 grams is the U.S. RDA basis for estimating % protein in meat, fish, poultry, milk, and eggs. Sixty-five grams is the basis for cereals, legumes, and other vegetables.

Percentage U.S. RDA of some common foods[1]

(Boxes with bold figures indicate significant sources of nutrients.)

Food	Amount or Description	Metric Weight (grams)	Calories	Percentage U.S. RDA						
				Protein	Vitamin A	Vitamin C	Thiamin	Riboflavin	Calcium	Iron[2]
MILK AND MILK PRODUCTS										
Milk, whole; yoghurt	1 cup	(240)	160	**20**	**6**	2	**6**	**25**	**30**	–
skim, unfortified; buttermilk	1 cup	(240)	90	**20**	–	2	**6**	**25**	**30**	–
modified skim (99% fat free), fortified	1 cup	(240)	120	**25**	**10**	2	**6**	**25**	**30**	–
evaporated, undiluted	1/2 cup	(120)	160	**20**	**8**	2	**4**	**25**	**30**	–
nonfat dry solids, fortified	3 tbsp.; 1 cup reconstituted	(23; 240)	90	**20**	**10**	2	**6**	**25**	**30**	–
Milkshake, chocolate	10 ounces (1 cup whole milk)	(345)	400	**25**	**15**	2	**6**	**35**	**40**	4
Cheeses: cheddar; American; Swiss; processed	1 ounce (1-1/4" cube)	(30)	115	**15**	**6**	–	2	**8**	**20**	–
Cheese, cottage creamed	1/2 cup	(115)	120	**30**	4	–	2	**15**	**10**	–
Ice cream (10% fat)	1/2 cup	(115)	130	6	6	–	2	**8**	**10**	–
Milk pudding, vanilla	1/2 cup	(130)	140	**10**	4	–	2	**12**	**15**	–
Cream, half-half	1/4 cup	(60)	80	4	6	–	–	**6**	6	–
VEGETABLES										
Important Sources of Vitamins A and/or C[3]										
Broccoli	1/2 cup cooked	(75)	20	4	**40**	**120**	6	**10**	**8**	4
Brussels sprouts; green pepper	1/2 cup cooked; 1 medium pepper	(75; 90)	25	4	**10**	**110**	4	4	2	6
Cabbage; cauliflower	2/3 cup raw; 1/2 cup cooked	(90)	15	2	2	**50**	2	2	4	2
Carrots	1/2 cup cooked or raw	(80)	30	2	**150**	**10**	4	2	2	2
Greens: beet; chard; collards; kale; mustard; spinich; turnip	1/2 cup cooked	(100)	20	2	**100**	**50**	6	**10**	**10**[4]	8
Plantain, green or ripe	1/2 cup cooked	(100)	140	2	**25**	**10**	4	2	–	2
Squash, winter; pumpkin; calabaza	1/2 cup cooked	(100)	60	2	**90**	**20**	4	6	2	4
Sweet potato; yam, yellow	1/2 cup cooked	(100)	120	2	**120**	**20**	4	2	2	4
Tomatoes, raw; canned; juice	1 small; 1/2 cup	(100)	20	2	**15**	**35**	4	2	–	4
Other Vegetables										
Asparagus	1/2 cup cut pieces	(80)	15	2	**15**	**30**	8	8	2	4
Beans, lima	1/2 cup cooked	(80)	95	10	4	**20**	**10**	4	4	10
Beans, snap	1/2 cup cooked	(60)	15	2	8	**15**	4	4	4	4
Beets; onions	1/2 cup cooked	(80)	30	2	–	8	2	2	–	2
Celery; cucumber; radishes	1/2 cup sliced	(50)	10	–	–	8	–	–	–	–
Corn	1/2 cup cooked; 1-5 inch ear	(80; 140)	85	4	6	8	2	4	–	4
Lettuce, crisp head; loose leaf	1 cup shredded	(55)	8	–	8	8	2	4	–	4
Peas, green	1/2 cup cooked	(80)	65	8	**10**	**25**	**15**	6	2	8
Turnips; rutabaga	1/2 cup cooked	(80)	20	2	6	**25**	2	2	2	2
Mushrooms	1/2 cup cooked	(120)	20	4	–	2	–	**15**	–	2
Potatoes, white	One: 4 per lb.	(100)	85	2	–	**25**	6	2	–	4
Potatoes, white, mashed	1/2 cup, milk and butter added	(100)	90	4	–	**20**	6	4	2	2
Squash, summer: zucchini; crookneck	1/2 cup cooked	(100)	15	2	8	**15**	4	4	2	2
Viandas[5]	1/2 cup cooked	(100)	90–130	2	4	4	4	2	–	4

FRUITS

Important Sources of Vitamins A and/or C[3]

Apricots, canned in syrup	1/2 cup	(130)	110	–	**35**	6	–	2	–	2
Cantaloupe	1/4 (5 inch diameter)	(230)	40	–	**90**	**70**	2	2	–	2
Grapefruit, white (edible portion); juice	1/2 (4 inch diameter); 1/2 cup	(120)	50	–	–	**70**	4	2	2	2
Mangos, raw	1/2 cup sliced	(80)	55	–	**80**	**45**	2	2	–	2
Orange (edible portion); juice	1 (2-1/2 inch diameter); 1/2 cup	(120)	65	–	4	**100**	6	2	4	2
Peaches, raw	One: 4 per lb.	(100)	40	–	**25**	**15**	2	4	–	2
Strawberries, raw; frozen, sweetened	1 cup	(150; 250)	60; 250	–	2	**150**	2	6	4	8
Watermelon	1 cup diced	(160)	40	2	**20**	**20**	4	2	2	4

Other Fruits

Apples; applesauce, sweetened	One: 3 per lb.; 1 cup	(150; 240)	85; 200	–	2	**10**	2	2	–	4
Bananas	1 medium; 1 cup sliced	(175)	100	2	4	**20**	4	4	–	4
Blueberries; raspberries	1/2 cup unsweetened	(65)	40	–	–	**25**	–	2	–	2
Canned fruit in syrup; cocktail; pears	1/2 cup	(120)	80	–	2	2	–	–	–	2
Grapes	1/2 cup	(75)	60	–	–	6	2	–	–	2
Pears	One: 2-1/2 per lb.	(180)	100	–	–	**10**	2	4	–	2
Pineapple, raw	1/2 cup diced	(75)	40	–	–	**20**	4	–	–	2
Prunes, dried; juice	5 medium; 1/2 cup	(30; 120)	80; 120	–	**10**	2	2	2	2	10
Raisins, seedless	1/3 cup; 1-1/2 oz. package	(45)	120	2	–	–	2	2	2	8

MEAT, FISH, POULTRY, EGGS, LEGUMES

Beef; veal; lamb	3 ounces cooked, lean only	(90)	180–225	**50**	–	–	6	**10**	–	15
Chicken, fried	1 drumstick and thigh	(125)	250	**50**	–	–	4	**10**	–	8
Chicken; turkey	3 ounces, no skin	(90)	180	**50**	–	–	4	**10**	–	8
Fish: clams; shrimp	3 ounces meat, no fat/breading	(90)	100	**50**	–	–	4	6	8	15[6]
haddock; perch; cod	3 ounces, no fat added	(90)	100	**50**	–	–	4	6	2	6
tuna, canned	3 ounces, in water; in oil	(90)	110; 170	**50**	–	–	4	6	2	6
Hamburg	3 ounces cooked	(90)	250	**45**	–	–	4	**10**	–	15
Hot dogs; bologna; cold cuts	1 hot dog; 2 ounces	(60)	160	**15**	–	–	6	6	–	6
Liver	2 ounces, no fat added	(60)	135	**35**	**500**	**15**	**10**	**120**	–	25
Pork; ham	3 ounces cooked, lean only	(90)	300	**45**	–	–	**40**	**10**	–	15
Pork sausage, cooked	1 link; 16 per lb.	(20)	95	6	–	–	4	2	–	2
Eggs	1 large	(50)	80	**15**	**10**	–	4	**8**	2	6
Legumes: dried beans; peas	1 ounce dried; 1/2 cup cooked	(30; 90)	125	**15**	–	–	**10**	4	4	15
Peanut butter; nuts	2 tbsp. peanut butter; 1/4 cup	(30)	190	**15**	–	–	4	4	–	4

CEREAL PRODUCTS, WHOLE GRAIN/ENRICHED[7]

Bread; toast; bagel	1 slice; 1/2 bagel	(25)	70	4	–	–	**6**	4	2	8
Cereals: oatmeal; wheat	1 cup cooked	(240)	110	4	–	–	**10**	4	–	6
ready-to-eat	1 ounce	(30)	100	refer to label on package						
Corn grits; corn meal	1 cup cooked	(240)	125	4	2	–	**8**	4	–	6
Hamburg roll	1 medium	(40)	120	6	–	–	**10**	6	2	10
Spaghetti; macaroni; noodles; rice	1 cup cooked	(150–200)	200	8	–	–	**15**	6	2	8

1. References: **Composition of Foods,** Agriculture Handbook No. 8, USDA, 1963; **Nutritive Value of American Foods in Common Units,** Agriculture Handbook No. 456, USDA, 1975; **Food Values of Portions Commonly Used,** Bowes and Church, Lippincott, 1970; **Tabla de Composicion de alimentos de use corriente en Puerto Rico,** Reguero y Santiago, University of Puerto Rico, 1974; California Prune Advisory Board, 1973.
2. See introduction for explanation about lack of shading in iron column.
3. Highest vitamin A content is found in darker yellow-orange and green vegetables and fruits.

4. Some calcium in spinach, swiss chard or beet greens may combine with a plant acid and may not be absorbed.
5. Yautia (white tanier), ñame (white yam), malanga (taro, dasheen), yuca (cassava). Yuca has somewhat more vitamin C than listed.
6. Clams provide 30% iron.
7. Values for thamin, riboflavin and iron are based on enrichment levels specified by FDA, October 1973.

NOTE: Some figures represent judgments made to help the user identify the most dependable sources of individual nutrients.

An Extension publication of the Division of Nutritional Sciences, a division of the New York State College of Agriculture and Life Sciences and the New York State College of Human Ecology, Statutory Colleges of the State University, Cornell University, Ithaca, New York.

Published pursuant to a contract with the New York State Education Department with partial funding from USDA, Food and Nutrition Service, Nutrition Education and Training Program (PL 95-166).

Cooperative Extension, New York State College of Agriculture and Life Sciences, New York State College of Human Ecology and the New York State College of Veterinary Medicine, Cornell University and the U.S. Department of Agriculture, cooperating. In furtherance of Acts of Congress May 8 and June 30, 1914 and providing equal opportunities in employment and programs. Lucinda A. Noble, Director of Cooperative Extension, Ithaca, New York 14853.

Available from: Mailing Room 7
Research Park
Cornell University
Ithaca, NY 14853